Small Navigation Project
Detailed Project Report
and
Environmental Assessment

Smith Cove
Gloucester Harbor
Gloucester, Massachusetts

US Army Corps
of Engineers
New England Division

MAR 1990

WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE, GLOUCESTER HARBOR
GLOUCESTER, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

EXECUTIVE SUMMARY

This report presents the findings of a study of navigation conditions in Gloucester Harbor, Gloucester, Massachusetts. The objective was to determine the feasibility of Federal involvement in access channel and anchorage improvements for commercial fishing operators as a modification to the existing Federal navigation project in Gloucester Harbor. Navigation conditions in Gloucester Harbor, specifically anchorage area, are not sufficient to accommodate the demand. This, coupled with ongoing onshore development, will force some commercial operators to moor outside the protected harbor and incur increased operating costs.

Due to physical constraints throughout Gloucester Harbor, it was determined that Smith Cove is the only protected area within the harbor that could be developed to satisfy the need for additional anchorage. This study evaluated navigation improvement alternatives within Smith Cove for providing additional safe, and efficient access and mooring space.

Three alternatives with varying depths were developed based on the projected fleet's characteristics. The optimum plan of improvement, identified as the National Economic Development plan, provides for an access channel 80 feet wide by 8 feet deep at mean low water along the west side of Smith Cove to a 2.5 acre by 8 feet deep anchorage to be constructed at the south end of the cove. Approximately 33,000 cubic yards of silty ordinary material and 1,000 cubic yards of ledge would be removed, almost exclusively from the proposed anchorage area, by mechanical bucket dredge after fragmenting the rock. The material would be placed in a barge and towed to the Foul Area, an EPA approved interim ocean disposal site located about 13 nautical miles east of Gloucester.

Construction of the recommended plan was determined to have no significant cultural/historical or social impacts. It was also determined however, that after realigning the proposed project to minimize effects, approximately 2 acres of intertidal habitat would be adversely impacted. In response to the environmental impact, a mitigation plan was developed and is included as part of the recommended plan. The recommended mitigation plan provides for marsh restoration in the Gloucester/Annisquam River system, which satisfies the "no net loss" goal of Federal and State agencies. Costs to restore 2 acres of degraded marsh is estimated at $68,000 and is included in the recommended plan's project cost. For a detailed description of the mitigation analysis see the Environmental Assessment included in this report.

The total investment cost of construction for the recommended plan of improvement, based on October 1989 price levels, is estimated to be $640,000. Annualized benefits, at October 1989 price levels, are $123,000 and annual costs are estimated at $66,000. This results in net annual benefits of $57,000 with a benefit to cost ratio of 1.9.

The non-Federal project sponsor is the Commonwealth of Massachusetts in cooperation with the city of Gloucester, and is required to contribute 20 percent of the first cost of construction currently estimated at $128,000. These cost sharing requirements are in accordance with the Water Resources Development Act of 1986 (Public Law 99-662). For detailed information concerning cost sharing requirements, refer to the Draft Local Cost Sharing Agreement enclosed in this report.

Future maintenance dredging would be accomplished by the Federal government contingent upon the availability of maintenance funds, the continuing justification of the project, and the environmental acceptability of maintenance activities.

The Division Engineer finds that improvement to the existing Federal navigation project in Gloucester Harbor, Gloucester, Massachusetts would enhance the commercial fishing fleet's operating efficiency, and result in significant economic benefits to commercial fishing operators, exceeding annualized project construction costs. For this reason, Federal involvement in providing navigation improvements to Smith Cove, Gloucester Harbor is recommended.

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Smith Cove
Gloucester Harbor
Gloucester, Massachusetts

MAIN REPORT

INTRODUCTION

This Detailed Project Report (DPR) is the result of a planning, engineering, economic and environmental feasibility study of navigation improvements at Gloucester harbor, Gloucester, Massachusetts. It was initiated in response to receipt of a letter from the City of Gloucester dated March 11, 1981 requesting the Army Corps of Engineers conduct an investigation of dredging needs and opportunities in the harbor. Gloucester Harbor (see Figure 1) is a well protected harbor that is home port to an extensive commercial fishing fleet. The harbor is operated at capacity. Onshore economic development has added to the strain on the harbor resources to provide adequate anchorage area. To address this problem, specific local concerns concentrated on providing unobstructed access to additional mooring space effecting improved operating efficiency of the commercial fishing fleet.

The first phase of the study provided for a reconnaissance investigation to determine if Federal involvement in providing navigation improvements in Gloucester Harbor was warranted. The reconnaissance report concluded that initiation of a detailed study was justified. This DPR presents the findings of the detailed study which examined alternative plans of improvement to navigation conditions in Gloucester Harbor.

Study Authority

This DPR is prepared and submitted under the authority and provisions of Section 107 of the 1960 River and Harbor Act, as amended.

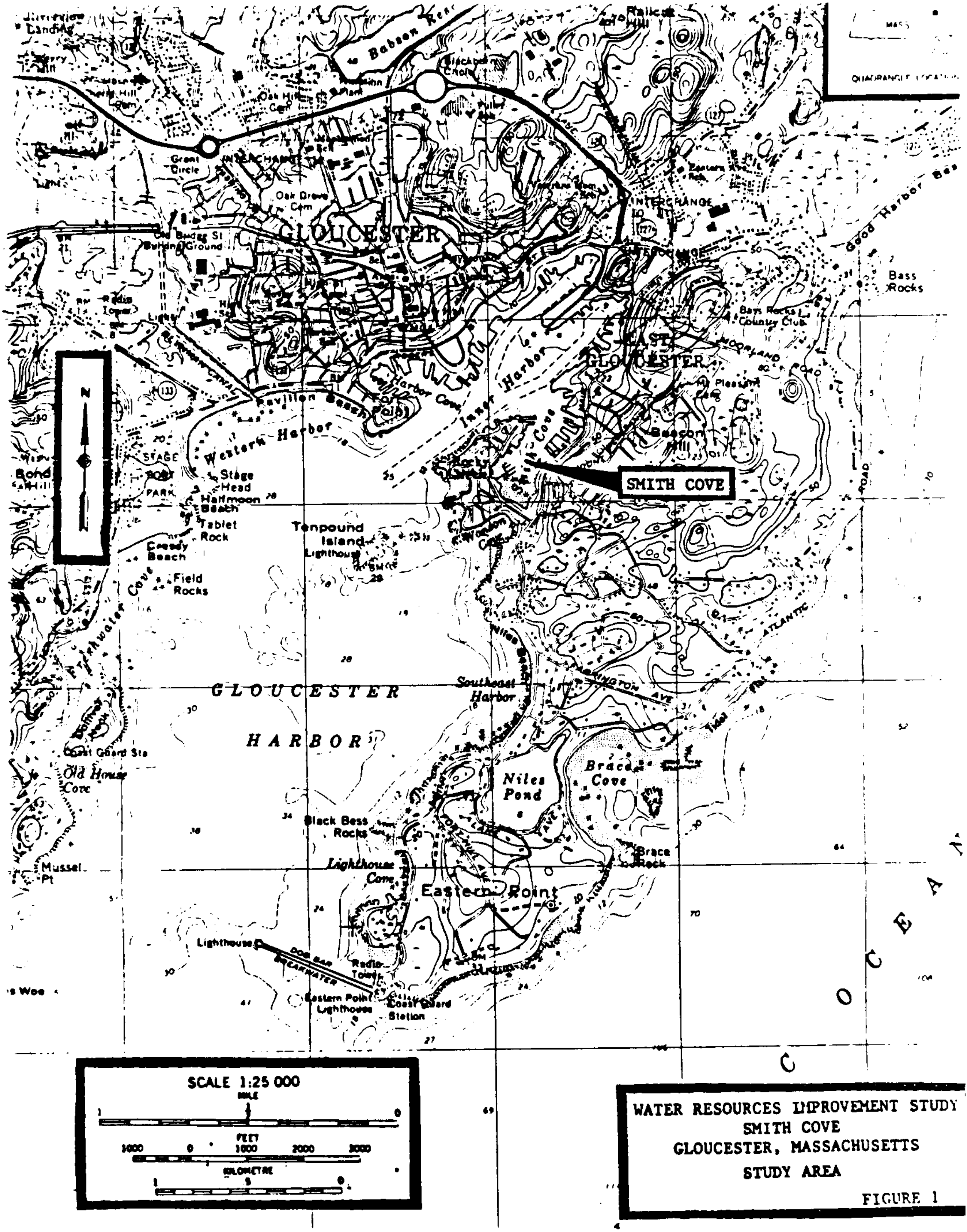
Scope of Study

The scope of study involved:

- The determination of the navigational problems and needs of the area,
- The determination of the most probable future condition without Federal improvements
- The development of alternative plans of improvement,
- The evaluated of engineering, economic, environmental, and social impacts of the alternative plans with respect to existing and future conditions,
- The recommendation of improvements that are engineeringly and economically feasible, environmentally acceptable, and socially beneficial.

The geographic scope of the study is:

- The Gloucester Inner Harbor area,
- Smith Cove and its surroundings,
- Other areas possibly impacted by the project including proposed disposal sites.



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS
STUDY AREA

FIGURE 1

Prior Studies and Reports

Federal

Gloucester Harbor has been the subject of earlier Federal reports which date back to 1872. Earlier project authorizations have concerned themselves with the removal of rock areas, construction of breakwaters and dredging. Construction of the existing Federal navigation project was completed in 1965.

The existing Federal project in Gloucester Inner Harbor shown in Figure 2 includes the following:

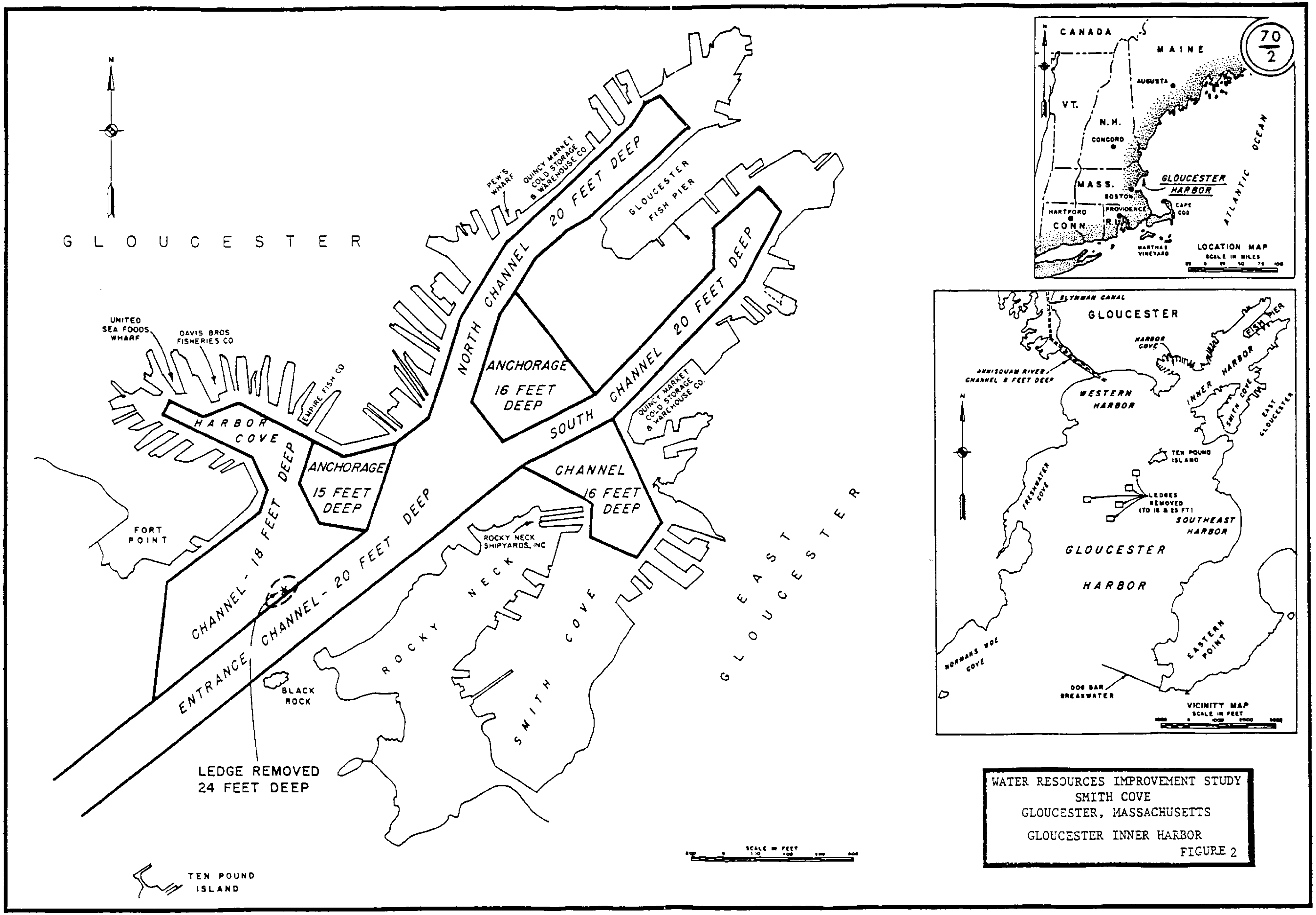
- an entrance channel into the Inner Harbor, 300 feet wide and 20 feet deep at mean low water (MLW), with a turning basin 600 feet wide.
- an access channel, 200 to 250 feet wide and 20 feet deep (MLW), along the waterfront to the northwest of the Gloucester Fish Pier.
- an access channel, varying from 500 to 100 feet wide and 18 feet deep (MLW), along the waterfront west of Harbor Cove, into Harbor Cove.
- an anchorage of about 10 acres, 16 feet deep (MLW), at the entrance to Smith Cove.
- removal of an isolated shoal adjacent to the entrance channel south of Harbor Cove to a depth of 24 feet (MLW).

Prior to the work completed in 1965, dredging of Lobster Cove, near the northern end of the Annisquam River, was completed in 1958. The Dog Bar Breakwater was completed in 1940. Removal of ledge, boulders, and pinnacle rock from Gloucester Harbor was performed in 1894, 1896, and 1905. Total cost of the entire existing Federal project has been $1,300,934 including $25,000 from local interests. The existing Federal project in Gloucester Outer Harbor is shown in Figure 3.

Non-Federal

The City of Gloucester and the Commonwealth of Massachusetts have also made significant investments to improve Gloucester Harbor. In 1985, 21 public and private sites within the inner harbor were dredged as part of a coordinated community dredging program. Funding for the projects were provided by city, State, and private interests.

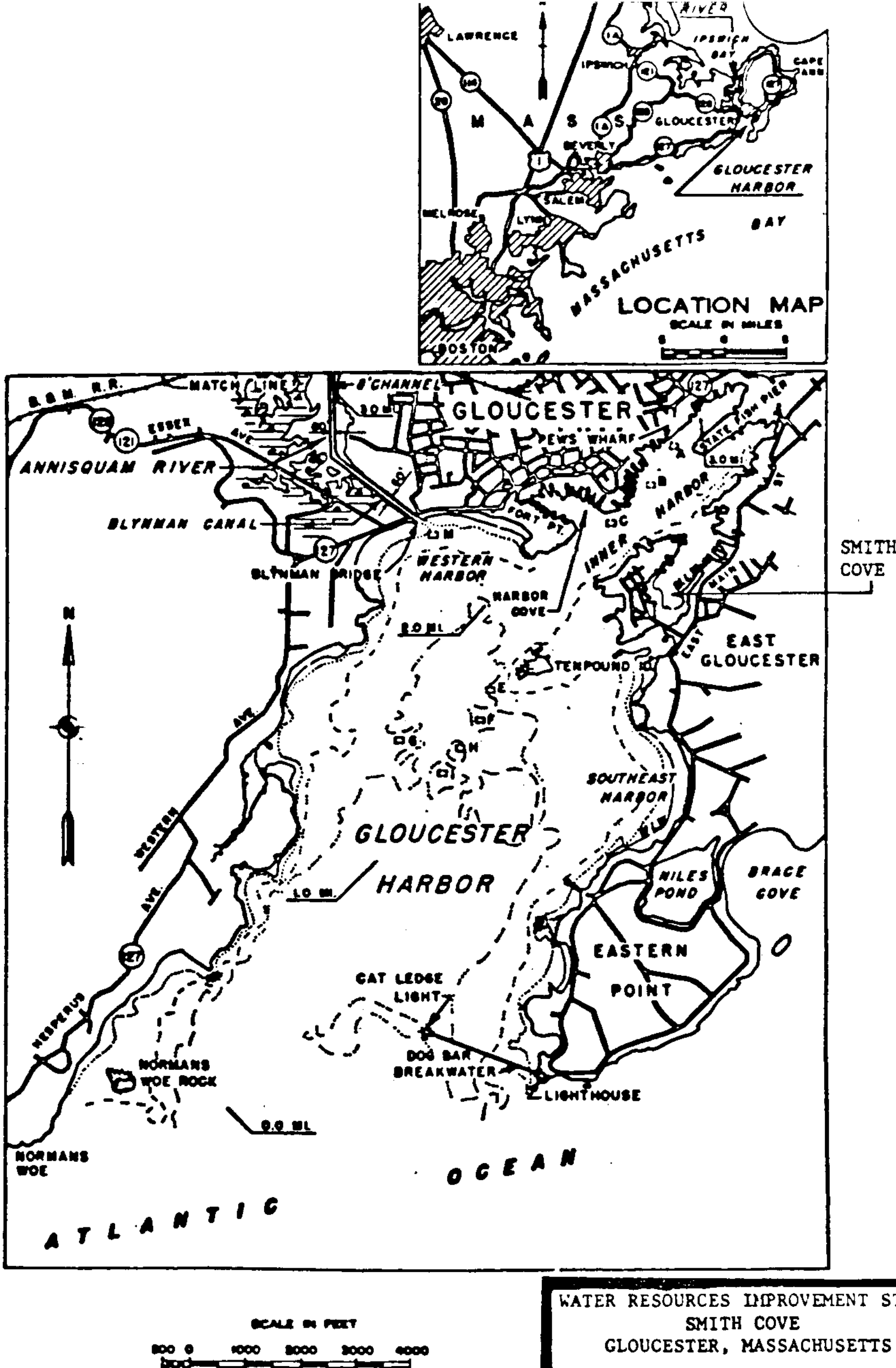
At the State Fish Pier, the Head of the Harbor project provides for land acquisition, a fish processing plant, and plans for three additional plants. The cost of this project is approximately $675,000. This project required the displacement of nine commercial moorings. These boats have been temporarily moored along the North Channel in the inner harbor. The State Fish Pier is also the site of proposed bulkhead and pier improvement and new construction that will provide additional commercial fishing facilities. Construction of this project is scheduled to commence during the fall of 1989. Estimated cost of the project is $7,000,000.



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

GLOUCESTER INNER HARBOR

FIGURE 2



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

GLOUCESTER OUTER HARBOR

FIGURE 3

Gloucester is world renown for its fishing industry. As shown by the recent significant investments that local and state interests have made in Gloucester Inner Harbor, the efficiency and competitiveness of the commercial fishing fleet in Gloucester is of the utmost importance to the region.

Study Participants and Coordination

The detailed study and the preparation of this report required close coordination with pertinent Federal and State agencies, and City of Gloucester officials and interested individuals. Public involvement was actively pursued including numerous meetings with local officials and interests to obtain information direct from people closest to the commercial interests and the prospective users of the proposed project. Based on information obtained, planning objectives and constraints were identified. See Appendix 3, Pertinent Correspondence Received, to review notable letters received prior to public distribution of this draft report.

The Report

This DPR summarizes the findings of a detailed investigation to determine the feasibility of Federal participation in providing navigation improvements in Gloucester Harbor. Study efforts included the comprehensive inventory of available information, performance of a hydrographic survey, subsurface explorations, environmental sampling and testing, and preparation of alternative plans of improvement. Alternative plans were evaluated with interested parties and final plans were selected for detailed examination.

This report consists of a main report, and environmental assessment, and three appendices. The main report summarizes the planning process, presents the findings of various efforts performed to best evaluate the proposed alternative plans of improvement, and the Division Engineer's recommendation. The Environmental Assessment contains an examination of possible impacts to the environment resulting from construction of the proposed project. Appendix 1 is the Engineering and Investigations, Design and Cost Estimates, which presents the findings of field investigations including the construction cost estimate for the proposed project. Appendix 2 is the Social and Economic Effects Assessment. This section analyzes the social and economic impacts of the proposed project including the annualized benefits to the commercial fishing fleet derived from construction of the alternative plans of improvement. Appendix 3 contains pertinent correspondence received prior to public review of the Draft Detailed Project Report.

PROBLEM IDENTIFICATION

This section of the report discusses the nature and scope of problems incurred by the commercial fishing operators necessitating navigational improvements. It presents the planning objectives and constraints that direct subsequent planning efforts.

Gloucester Harbor is located in the City of Gloucester, Essex County, on the northern coast of Massachusetts about 25 miles northeast of Boston, Massachusetts. Gloucester is situated along the southern coast of the Cape Ann peninsula and is bordered by the towns of Rockport, Manchester and Essex. The City of Gloucester can be reached on State Highway Routes 128, 127 and 133. Gloucester and vicinity is located on National Ocean Survey charts numbered 13281 and 13279, entitled "Gloucester Harbor and Annisquam River" and "Ipswich Bay to Gloucester Harbor". The U.S. Geological Survey maps for Gloucester and Rockport can also be consulted to examine the topographic features of the area.

Historical Conditions

Gloucester's good natural harbor, and its location near some of the world's most productive fishing grounds at Georges Banks, has provided a rich maritime history. Europeans fished off of Cape Ann during the 1500's and early 1600's. In 1623 the first settlers came from Plymouth, Massachusetts following disputes with the Puritans. The next year another group arrived directly from England. Fishing became the dominant resource in Gloucester in the late 1600's and early 1700's when timber and farming declined due to the extensive rocky terrain in the area. Fishermen began making 10 to 12 week perilous trips to the prime fishing grounds of Georges Bank. This necessitated construction of larger boats. The first schooner was built by a Gloucesterman in 1713. From 1713 to the Revolutionary War, Gloucester flourished with fishing, shipbuilding, and international trade, known as the "Triangle Trade" between Gloucester, Mediterranean ports and the West Indies.

The years during and between the Revolutionary War and the War of 1812 saw a decline in the fishing trade due to a British navy threat that cut off trade. After the wars, Gloucester experienced a resurgence into the fishing industry. By 1866 Gloucester led all ports in the new world in fishing. There were 400 fishing boats and 5,000 men sailing out of Gloucester. Including a large percentage of immigrants, population increased from 5,000 to 25,000 between 1776 and 1860's. In 1874 Gloucester was incorporated as a city.

After 1880, modernization and competition resulted in the gradual decline of Gloucester fishing. The advent of diesel power in 1900 closed down ship building on Cape Ann. Industry, and specifically fish processing and recreation, became important segments of the local economy. In the 1930's fishing made a partial comeback, but the decline continued. However, a renewed growth in Gloucester fishing has occurred over the past 15 years. The port continues to be a major contributor to the national fishing industry, and it retains its leadership role in New England.

Existing Conditions

Gloucester is a combination of scenic beauty and commercial fishing industry. Service related businesses and recreational areas support tourism while commercial activities around the inner harbor provide for the dominant fishing industry in Gloucester. Land use around the inner harbor is utilized in the following percentages: Residential 25, Parking Lots 23, Institutional use 15, and Industrial use 37. Of the 37 percent industrial use, 20 percent is for fish and food processing.

Gloucester is comprised of an inner and outer harbor. The inner harbor is the developed working part of Gloucester Harbor. The harbor experiences a tidal range of 8.8 feet. Smith Cove is located in the southeast portion of the harbor.

The existing Federal project in Gloucester Harbor was adopted in 1888 and supplemented by further enactments, the latest being in 1962. The project provided for a breakwater extending 2,250 feet from Eastern Point over Dog Bar to Cat Ledge. The project also included the removal of various ledge areas in both the outer and inner harbors. Specific navigation features are described in the <u>Prior Studies and Reports</u> section of this report.

Gloucester is a very active harbor with commercial fishing and recreational boating extensively pursued. This boating activity also attracts significant tourism to the harbor area. The inner harbor area contains 8 marinas with a total of 230 recreational craft at slips or moorings. The permanent commercial fishing fleet numbers approximately 160 vessels. No vacant dockage space exists. Rafting of vessels at the docks is used extensively throughout the harbor in an attempt to accommodate as many vessels as possible.

Gloucester is one of the largest fishing ports in the United States. Seventy-five piers and wharves exist in the inner harbor with 90 percent devoted to the fishing industry. Nine fish purchasing companies operate within the inner harbor. Additionally, construction is underway for a new processing plant, and plans call for three more fish processing plants to be constructed.

The Gloucester fishing fleet lands primarily groundfish and lobster. The major species landed in terms of volume are Cod, Flounder, Haddock, Sea Herring, Whiting, Pollock, and Sea Scallops. Lobster is not caught in large volumes, however it does command a high value. The fishing grounds for finfish for the Gloucester fishing fleet are Georges Bank and Brown Bank, located approximately 50 to 70 nautical miles from the harbor.

The period of 1965 to 1982 saw a 90 percent increase in the number of vessels employed in the New England groundfish industry growing from 512 to 975. However, that same period experienced a 33 percent decline in landings. The value of landings increased partially offsetting the economic impact of reduced landings. Although profits overall are on the decline, they continue to be positive as evidenced by the net increase in new fishing operators entering the business. The finfish industry should continue to expand.

Review of the inshore lobster fishery for Massachusetts and Essex County shows that the number of lobster fishermen, catch volumes and effort, have all increased during the period of 1969 to 1982. Since 1980, catch per trap has remained relatively constant. As the number of fishermen and catch effort have continued to increase, it is expected that the lobster fishery industry can be expected to grow.

Commercial fishery landings and values in 1983 were sufficient to rank Gloucester seventh and eighth respectively, in a survey of major ports across the nation. The fishing industry provides the city of Gloucester with 40 percent of its employment and revenue.

Gloucester, with its extensive commercial fishing industry is continually seeking ways to improve and/or expand its prime resource, the harbor. As onshore development continues, the potential for increasing the fleet is stymied by the lack of mooring and dockage space. A study performed for the city of Gloucester regarding development of the inner harbor area yielded an almost unanimous opinion that this lack of space for commercial vessels is a prime concern.

Numerous studies have been performed pertaining to harbor development in Gloucester. Utilizing local and state funding, onshore development and the dredging of private and public berthing areas have been undertaken. The State Fish Pier redevelopment includes bulkhead, and pier and deck construction for commercial fishing facilities at a cost of $7,000,000. The State funded Head of the Harbor development project provides one new fish processing plant and future plans for three additional fresh fish processing plants. The investment estimate for this project is $675,000.

Smith Cove, located in the southeast corner of the inner harbor, is the only waterbourne area in the harbor that has a potential for further development. The cove is a small body of water about 800 feet wide by 1,300 feet in length. Smith Cove was created when a causeway was constructed on an intertidal bar between East Gloucester and the island of Rocky Neck. Both commercial and recreational boaters use the deep water portions of the cove extensively. The surrounding land use includes both water dependent and non-dependent commercial businesses. The west side contains marinas, restaurants, ship repair facilities and art galleries. The Rocky Neck Art Gallery is the oldest of its kind in the nation, featuring the scenic beauty of the Gloucester Harbor area. The east side is comprised mainly of private residences.

Smith Cove is well protected from wind and wave action due to the surrounding uplands and its northeasterly orientation. The cove connects to the inner harbor and a Federally authorized 16 foot deep at MLW anchorage The southern part of the cove contains shallow waters unusable for moorings and a 4 acre tidal mud flat. This unusable area of Smith Cove was identified during this study as having the potential for anchorage development. Depths in the cove increase in a northerly direction to about 18 feet at MLW. The bottom sediments are predominantly silts and clays.

The City of Gloucester is in the process of revitalizing and redeveloping its waterfront and marine related industries. Onshore development at the State Fish Pier relating to the Head of the Harbor project, required the removal of nine independent commercial fishing vessels, which were previously displaced from moorings at a nearby restaurant due to expansion there. The entire harbor is utilized to capacity and hence, no available mooring space exist to accommodate these fishing operators. The need for navigation improvements is evident. The fishermen would be forced to move their moorings to a nearby port, most likely in Beverly or Ipswich, Massachusetts. Due to a lack of commercial onshore support facilities there, these commercial fishing operators would have to continue to conduct business in Gloucester. This impending displacement of the vessels would impose approximately 3 additional hours of transit time per trip onto the fishermen. The result is increased operating costs.

Condition If No Federal Action Is Taken (Without Project Condition)

Gloucester Harbor is being operated at capacity. Due to the physical constraints of the harbor, the limited mooring/dockage space for vessels will remain constant. The recreational boating industry in New England is continually expanding and hence, placing more demand on mooring/slip space than ever before. These restrictions will hinder any attempt at commercial fleet expansion. The nature and characteristics of the existing fishing fleet should not change significantly.

Without Federal involvement in providing improvements to the existing navigation conditions in Gloucester Harbor, nine commercial fishing operators will be forced to relocate out of the harbor. Based on discussions with the fishermen, the most probable new home ports would be in either Beverly or Ipswich, Massachusetts. The fishermen also stated that due to the lack of onshore support facilities at the other ports, they would continue to conduct business in Gloucester. Approximately three additional hours of transit time would now be required, per trip, to travel from their new home port, to the fishing grounds, to Gloucester for offloading, and back to the new home port. The result is an increase in variable operating costs to the fishermen to land the same value of catch.

Maintenance of existing Federal navigation features to authorized limits will continue to occur, as needed, pending maintenance funding and continued project justification, at full Federal responsibility.

Funding from interests other than the Federal government would not be available to provide for the needed access and anchorage expansion in Gloucester Harbor. City officials have stated that the cost of the needed improvements is beyond their means to fully fund. Recently, the city and the state have invested significantly to improve the navigation and onshore support conditions in the harbor. Projects such as improving public access to the harbor, clean up of the harbor area, and pier and wharf improvements are all of concern to the city and it is making progress in achieving these goals.

Problems, Needs and Opportunities

The navigation problem facing Gloucester Harbor today is the lack of deep water anchorage space. The protected inner harbor is the working part of Gloucester Harbor and is beyond capacity in terms of dockage/mooring space availability Rafting of vessels at piers is extensively used to accommodate as many boats as possible.

There is a need for additional commercial anchorage area. Increases in fleet inefficiencies would be detrimental to the positive impacts of the city and state's previous efforts to improve the fishing industry in Gloucester. By providing the needed deep water mooring space thus enabling the affected fishermen to remain in the inner harbor, the fleet's efficiency and competitiveness is retained, and the local improvements, both accomplished and proposed, would be fully realized.

During the course of this study, in conjunction with city officials and interested parties, Smith Cove was identified as the only remaining potential site in the harbor that affords the opportunity of providing additional anchorage area to satisfy the need. Smith Cove is used extensively by both commercial and recreational boaters where natural depths allow. There are no excess deep water anchorage space available in the cove. The opportunity exists, through the dredging of shallow areas at the southern end of the cove, to provide deep water anchorage area. The shallow, unusable area available at the southern end of the cove has been evaluated in this study. Physical and institutional constraints limit the area available for improvement, however, the available area is sufficient for the needs of the commercial boats to be accommodated.

Planning Constraints and Objectives

Planning constraints are those parameters that limit the implementation of any proposed plan of improvement and serve to eliminate from consideration all those possibilities that offer no acceptable degree of satisfaction. These constraints can include natural conditions, economic factors, social and environmental considerations and legal restrictions.

The major constraints existing in Gloucester Harbor are physical, economic and institutional in nature. City officials, including the harbormaster, have confirmed that no available anchorage or slip space exists in the inner harbor. No excess harbor front property is available for local expansion of commercial slip space. Expansion is only possible through dredging existing non-usable protected water area. Through this study, in concert with city officials and interested persons, Smith Cove was identified as the only body of water in the protected inner harbor where expansion of existing mooring area is possible.

The surface area available for anchorage expansion in Smith Cove is limited due to physical characteristics, thus restricting the quantity of vessels it could serve. Fortunately, the area identified for the proposed anchorage expansion is sufficient to accommodate the needs of the fishing vessels displaced by the onshore development.

Economic constraints include the additional operating costs that would be incurred by the affected commercial fishing operators if displacement is allowed to occur. Other economic factors, such as the costs to construct a protective breakwater for additional safe anchorage in the outer harbor, are prohibitive.

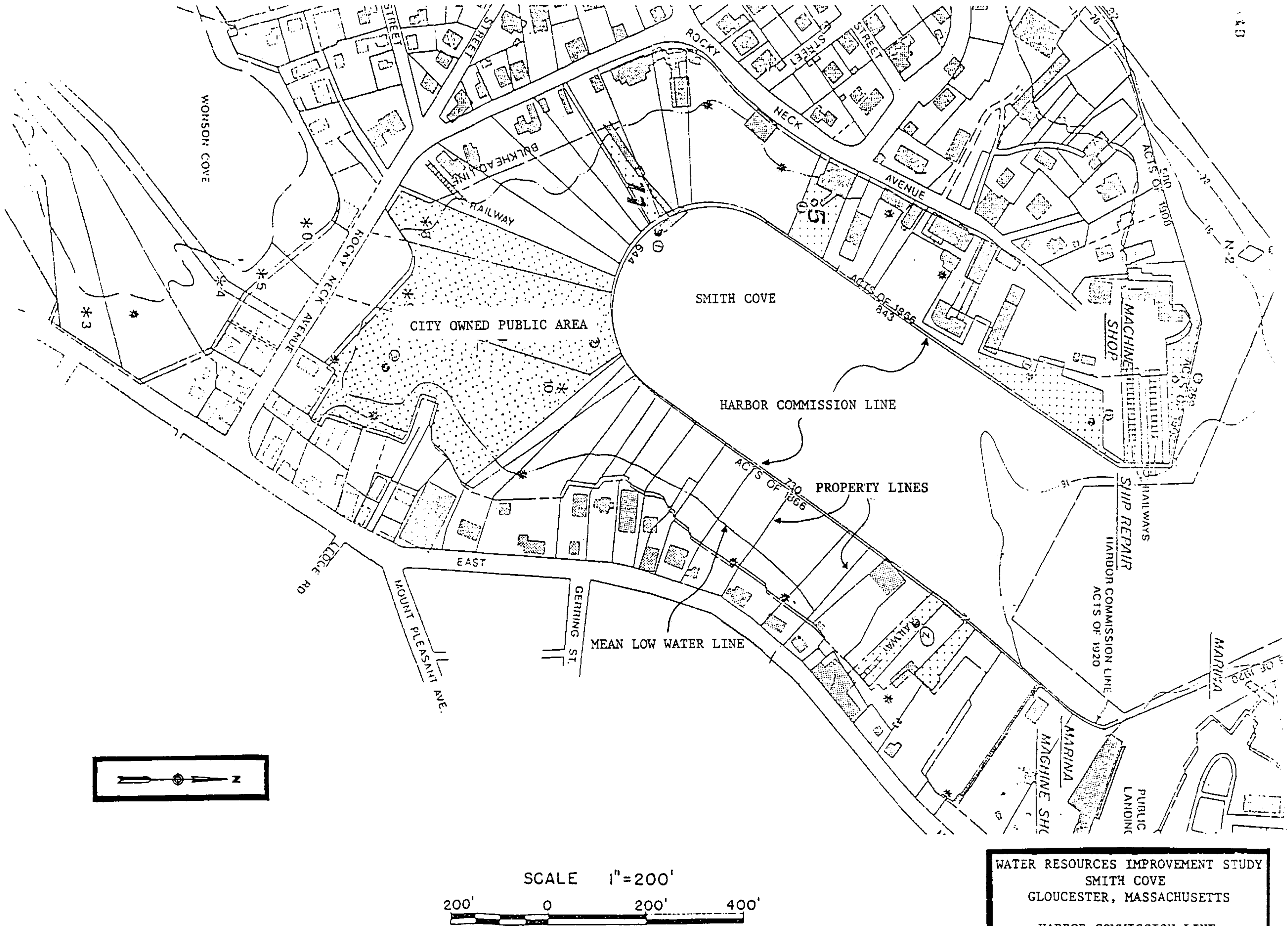
The third planning constraint is institutional (legal) in nature. As shown in Figure 4, Smith Cove contains a Harbor Commission line that marks the extent of private and public ownership extending from the shoreline into the cove. This is a factor in limiting the area available for anchorage expansion.

Planning objectives identified during this study address navigation problems and needs of Gloucester Harbor's commercial fleet where possible. These objectives are:

- Eliminate the need to displace commercial fishing operators from the harbor due to onshore development and hence,

- Eliminate significant increases in operating costs and inefficiencies to the existing commercial fishing fleet during the 1988 - 2038 period of analysis.

- Contribute to safer navigation through design considerations for the commercial boaters during the 1988 - 2038 period of analysis.



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

HARBOR COMMISSION LINE
FIGURE 4

PLAN FORMULATION

The consideration of the problems and needs of the study area led to the formulation of alternative plans. These plans are designed to achieve the planning objectives, and are developed with regard to the planning constraints and objectives previously identified. State and local objectives are important considerations in the formulation and evaluation of alternative plans.

Plan Formulation Rationale

The alternative plans were formulated, with as a basis, four considerations: completeness, effectiveness, efficiency, and acceptability. Each of the plans were formulated to be complete in of themselves and require no complimentary work to achieve the objective of improved navigation for the target commercial fishing interests. The alternatives were analyzed for their effectiveness in providing improved navigation for the projected project users. The alternative plan's level of efficiency was determined through comparative analysis of their cost effectiveness in achieving the desired objective. All plans were assessed for their level of acceptability to local interests and users, and State and Federal concerns.

The formulation of plans for navigation improvements at Smith Cove, Gloucester Harbor, are predicated on a standard set of criteria adopted to permit the development and selection of a plan which responds to the navigation problems and needs of the study area. Each alternative is considered on the basis of its contribution to the planning objectives. Selection of a specific plan is based on technical, economic, and environmental criteria which permits the fair and objective appraisal of the impacts and feasibility of alternative solutions.

Technical criteria require that the optimum plan have the facilities and dimensions necessary to accommodate the expected user vessels and sufficient areas to provide for maneuvering of boats and development of shore facilities.

Economic criteria require that the annual National Economic Development (NED) benefits of the navigation improvement exceed the annualized economic costs and that the scope of the project is such to provide maximum net annual benefits.

Environmental criteria require that the selected plan incorporate measures where necessary to preserve and protect the environmental quality of the project area. This includes the identification of impacts to the natural and social resources of the area and the minimization of those impacts that adversely affect the surrounding environment. Included here is the assessment of impacts that are expected to be incurred during the construction of the proposed navigation improvements, and those that occur due to activities attracted to the area after plan implementation.

Management Measures

A broad range of management measures can be identified and evaluated as the basis for formulating alternative plans to solve the navigation problems is Gloucester Harbor. These management measures are categorized as either structural or non-structural

Structural measures are identified as those that involve the construction of features that would, to varying degrees, meet the planning objectives developed for Gloucester Harbor. These alternatives include the construction of an access channel and anchorage in Smith Cove or the construction of a protective structure such as a breakwater in the outer harbor. Non-structural measures involve those solutions that would achieve the same objectives, but would do so by means not involving new construction, such as the transfer of vessels to neighboring ports.

Analysis of Alternatives Considered

A number of navigation improvement alternatives were developed and analyzed during the early stages of the planning study. These alternatives included various dredging options, construction of protective structures, realignment of boats currently moored in Smith Cove to accommodate the affected commercial vessels, and the transfer of the affected commercial vessels to neighboring ports.

The transfer of the fishing vessels to nearby harbors is predicated on the ability of these harbors to provide adequate protection, capacity, and efficiency of operation. None of the harbors in the area offer the necessary capacity and onshore support facilities required by the commercial fishermen to maintain an efficient operation in order to remain competitive. The affected fishermen would only incur additional operating inefficiencies, hence costs, in order to harvest the same value of catch. For the above reasons, this alternative was not pursued further.

To help solve the lack of mooring space in Gloucester's Inner Harbor, structural measures such as breakwater construction and dredging were evaluated. A breakwater could be constructed in the outer harbor to create a protected anchorage area behind it. Local acquisition of shorefront property and provision of adequate, access and transfer facilities would also be necessary for such a site. The cost of this alternative was prohibitive, especially when compared to the benefits that would be derived from its construction.

The potential of re-configuring the moorings of boats currently moored in Smith Cove was investigated. If small boats were found to be moored in waters with depths greater than their needs, the opportunity exists to displace those small boats for open mooring of the commercial vessels in need of deep water anchorage. A survey of the physical dimensions of the boats existing in the cove revealed that their mooring needs are generally the same or greater the needs of the commercial vessels being impacted. Hence, no gains would be accrued through displacing boats currently moored in Smith Cove.

The feasibility of providing the needed anchorage space through dredging was investigated. Smith Cove, located in the southeast part of the inner harbor, was determined to be the only body of water that showed a potential opportunity for anchorage expansion. Smith Cove is extensively utilized by both commercial and recreational boating interests where water depths permit. The potential for expansion exists at the south end of the cove. In this section of the cove water depths are not sufficient for moorings. However, the size of this shallow, unused area is adequate to accommodate the fishing boats that are being displaced. Based on accessibility, degree of protection, existing onshore facilities, and the ability of the existing conditions to provide the opportunity for anchorage expansion to serve the needs of the commercial fishermen, dredging a portion of Smith Cove was determined to be the most feasible solution.

Design criteria were used to determine project features that would most efficiently serve the needs of the users. Based on the physical characteristics of the commercial boats expected to utilize the proposed Federal improvement project, a design vessel was developed. Incorporating the dimensions of this boat, the tidal range, and depth of the proposed project; safe open mooring of the affected vessels was determined to require 2.5 acres of surface area. The appropriate width for the proposed access channel was determined to be 80 feet. Depth requirements were analyzed for project economic optimization.

COMPARISON OF DETAILED PLANS

The three alternative plans of improvement selected for detailed analysis vary in quantity of material to be removed and cost. Physical features of the plans differ in depth only, the channel and anchorage limits are constant for all plans as the design vessel and size of fleet are constant. As shown in Figure 5, Plan A provides for an access channel 80 feet wide by 6 feet deep at mean low water (MLW), along the west, more commercially oriented, side of the cove to a 2.5 acre anchorage dredged to 6 feet at MLW at the south end of the cove. Plan B proposes the same project features, only dredged to 8 feet at MLW (see Figure 6), and Plan C, as shown in Figure 7, proposes depths down to 10 feet at MLW. Figure 8 depicts how the proposed plans of improvement tie in with the existing Federal navigation project in the Inner Harbor.

Disposal alternatives were evaluated and coordinated with local, State and Federal Agencies for economic, environmental and social acceptability. No suitable upland disposal site was identified to receive the material to be dredged. Disposal of the dredged material in deep water was investigated. It was determined that ocean disposal at the Foul Area, an EPA approved interim open water site, is acceptable economically, environmentally and socially. The Foul Area ocean disposal site, shown on Figure 9, is located approximately 13 nautical miles east of Gloucester.

Environmental impacts at the dredging and disposal sites are similar for all plans. Environmental studies performed during this study showed that no significant adverse impacts would occur as a result of constructing the proposed navigation improvement plans. The Environmental Assessment section following the main report, presents a detailed description of environmental impacts.

Project Costs

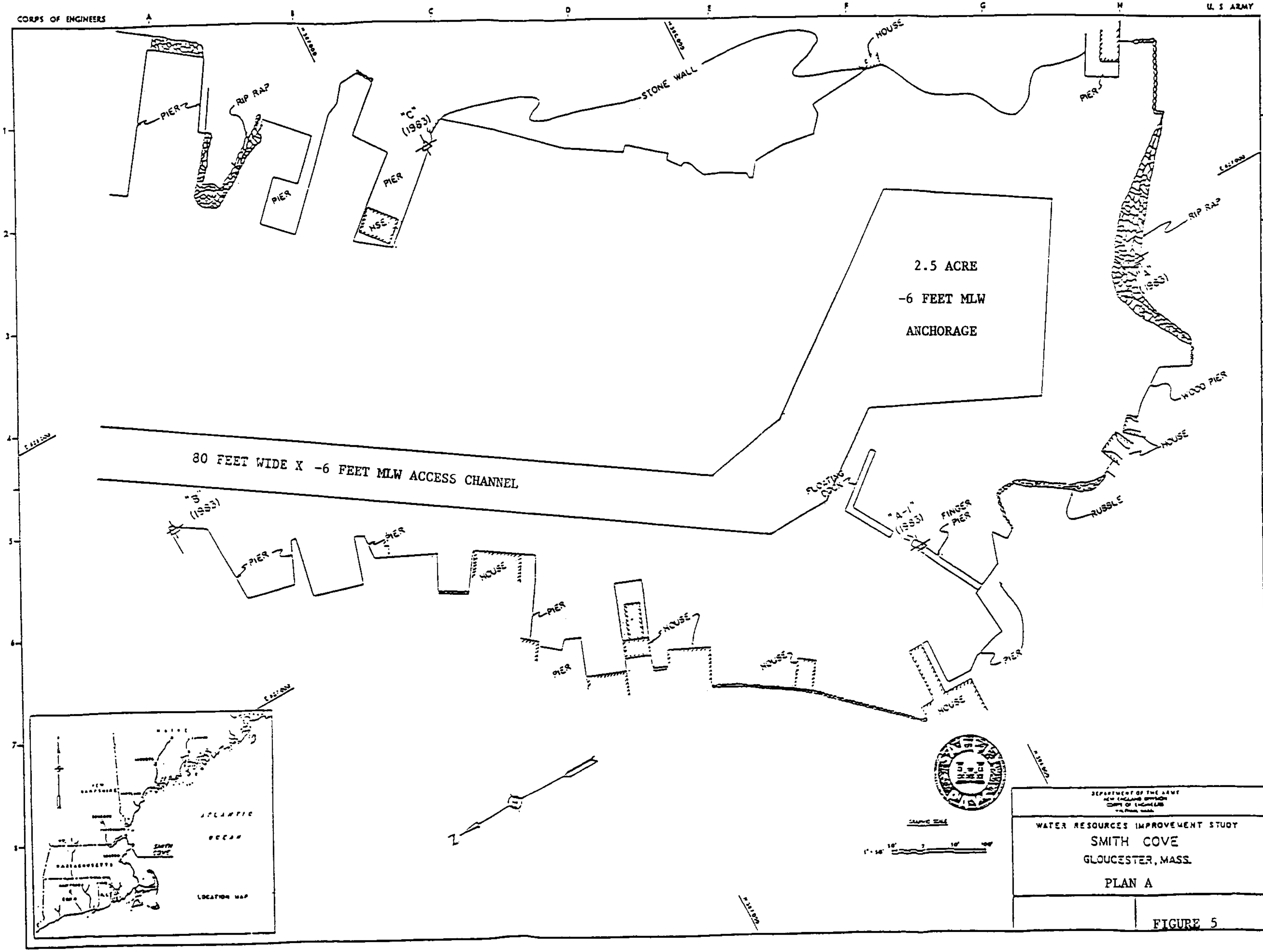
Construction of any of the proposed plans calls for the dredging of bottom sediments and removal of fragmented ledge rock using a drill rig and a barge mounted mechanical bucket dredge. Dredging would only be required for the proposed anchorage and the southern end of the proposed access channel. The remainder of the channel would be designated through the placement of navigation aids. The material to be removed would be placed in scow and towed to the Foul Area ocean disposal site.

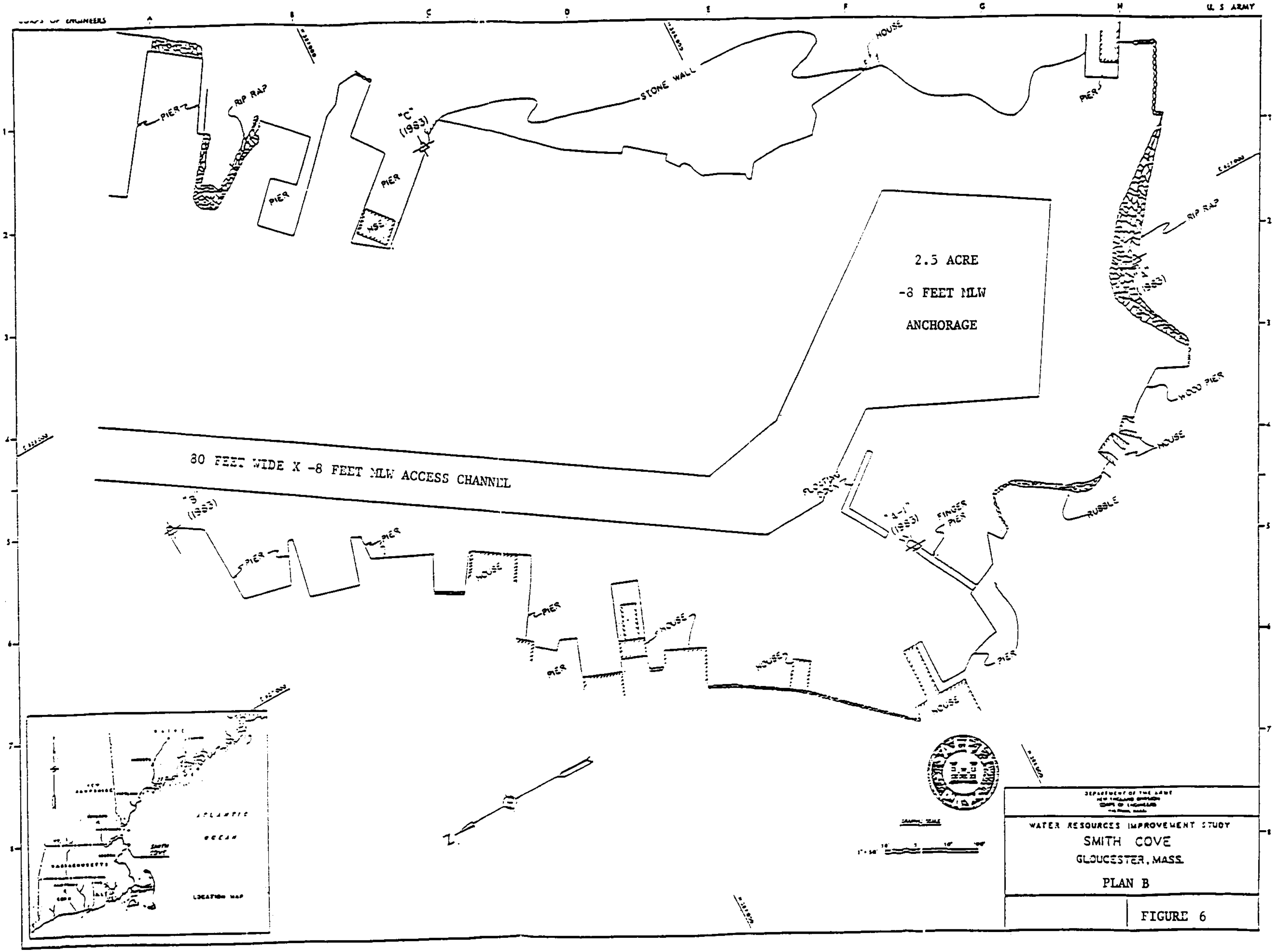
Construction costs and annual charges are directly related to the volume and nature of material to be dredged. Table 1 provides a quantitative description of the alternative plans of improvement. Table 2 compares construction costs, and Table 3 annual charges of the detailed plans. Annual amortization charges were calculated using the current fiscal year Federal interest rate of 8 7/8 percent over the 50 year project economic life. For further construction and cost information, refer to Appendix 1, Engineering Investigations - Design and Cost Estimates.

TABLE 1

SMITH COVE, GLOUCESTER HARBOR
DESCRIPTION OF DETAILED PLANS

FEDERAL PLAN FEATURES		PLAN A	PLAN B	PLAN C
Access Channel	- Length (ft.)	800	800	800
	- Depth (ft. below MLW.)	6	8	10
	- Width (ft.)	80	80	80
Anchorage	- Area (acres)	2.5	2.5	2.5
	- Depth (ft. below MLW.)	6	8	10
Volume to be Removed (cubic yards)				
	- Ordinary Material	22,000	33,000	46,000
	- Ledge Rock	500	1,000	2,000
		22,500	34,000	48,000
Construction Duration (months)		0.8	1.3	1.8


CORPS OF ENGINEERS
U. S. ARMY
PIER
RIP RAP
PIER
PIER
HSE
"C"
(1983)
STONE WALL
HOUSE
PIER
RIP RAP
2.5 ACRE
-6 FEET MLW
ANCHORAGE
WOOD PIER
HOUSE
RUBBLE
80 FEET WIDE X -6 FEET MLW ACCESS CHANNEL
"B"
(1983)
PIER
PIER
HOUSE
PIER
HOUSE
PIER
HOUSE
HOUSE
PIER
FLOATING
"A-1"
(1983)
FINGER
PIER
ATLANTIC
OCEAN
SMITH
COVE
LOCATION MAP
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
PLAN A
FIGURE 5



CORPS OF ENGINEERS
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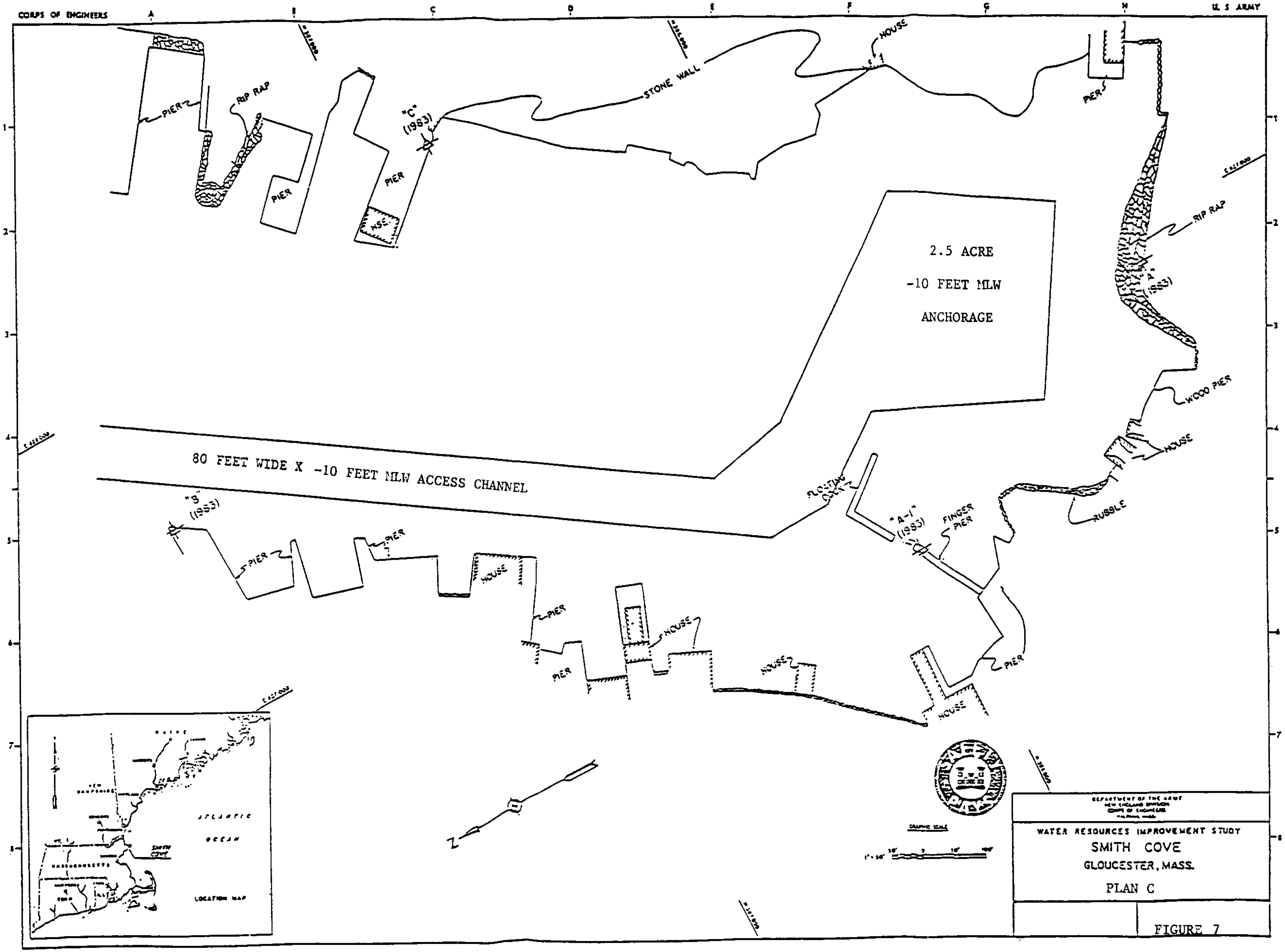
PIER
PIER
HOUSE
PIER
PIER
HOUSE
HOUSE
FLOATING DOCK
"A-1" (1983)
FINGER PIER
PIER
HOUSE
ATLANTIC OCEAN
MASSACHUSETTS
SMITH COVE
LOCATION MAP
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
PLAN B
FIGURE 6



CORPS OF ENGINEERS
U. S. ARMY
PIER
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PIER
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HSE.
"C" (1983)
STONE WALL
HOUSE
PIER
RIP RAP
"A" (1983)
2.5 ACRE
-10 FEET MLW
ANCHORAGE
WOOD PIER
HOUSE
RUBBLE
80 FEET WIDE X -10 FEET MLW ACCESS CHANNEL
FLOATING DOCK
"A-1" (1983)
FINGER PIER
"S" (1983)
PIER
PIER
HOUSE
PIER
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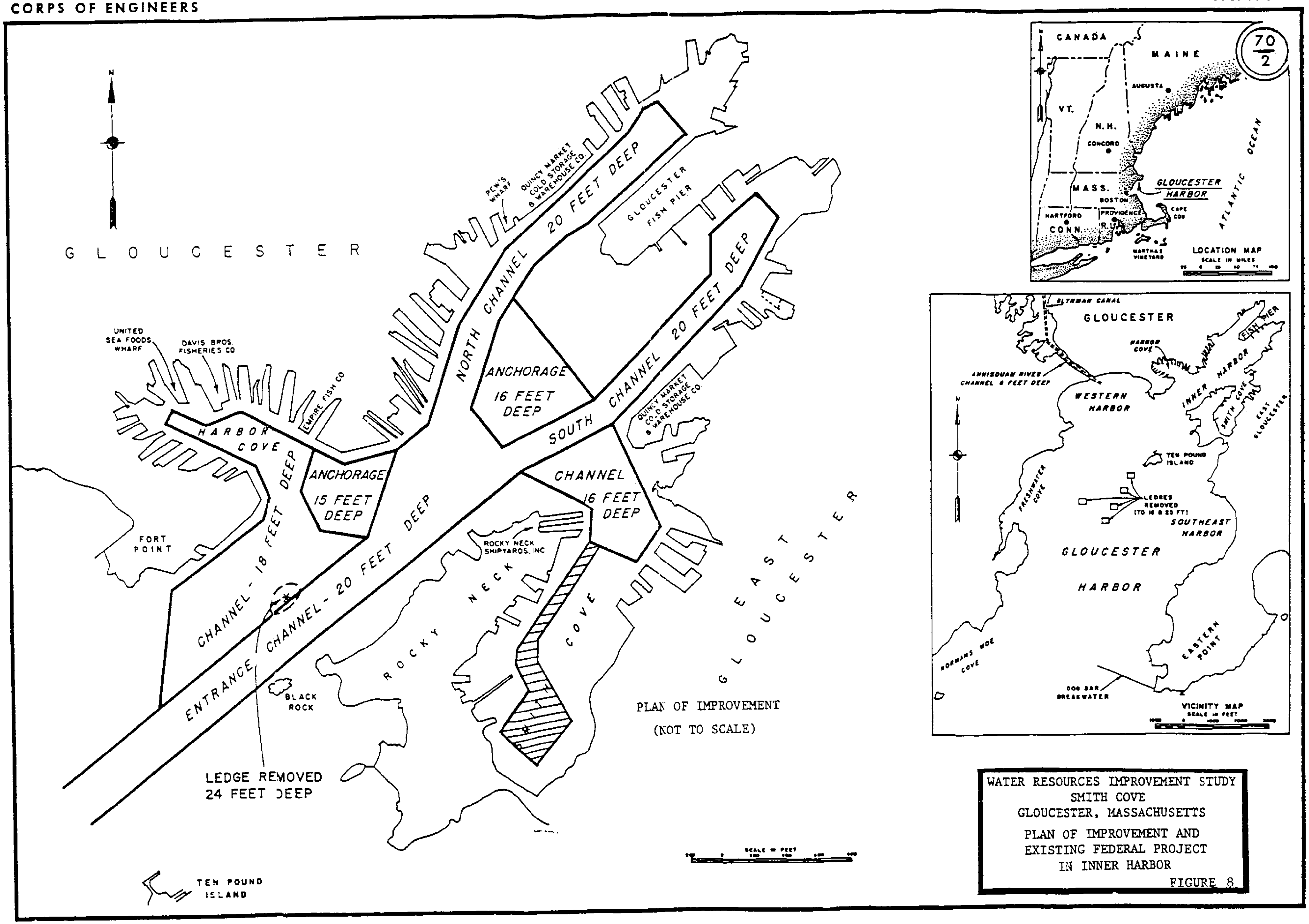
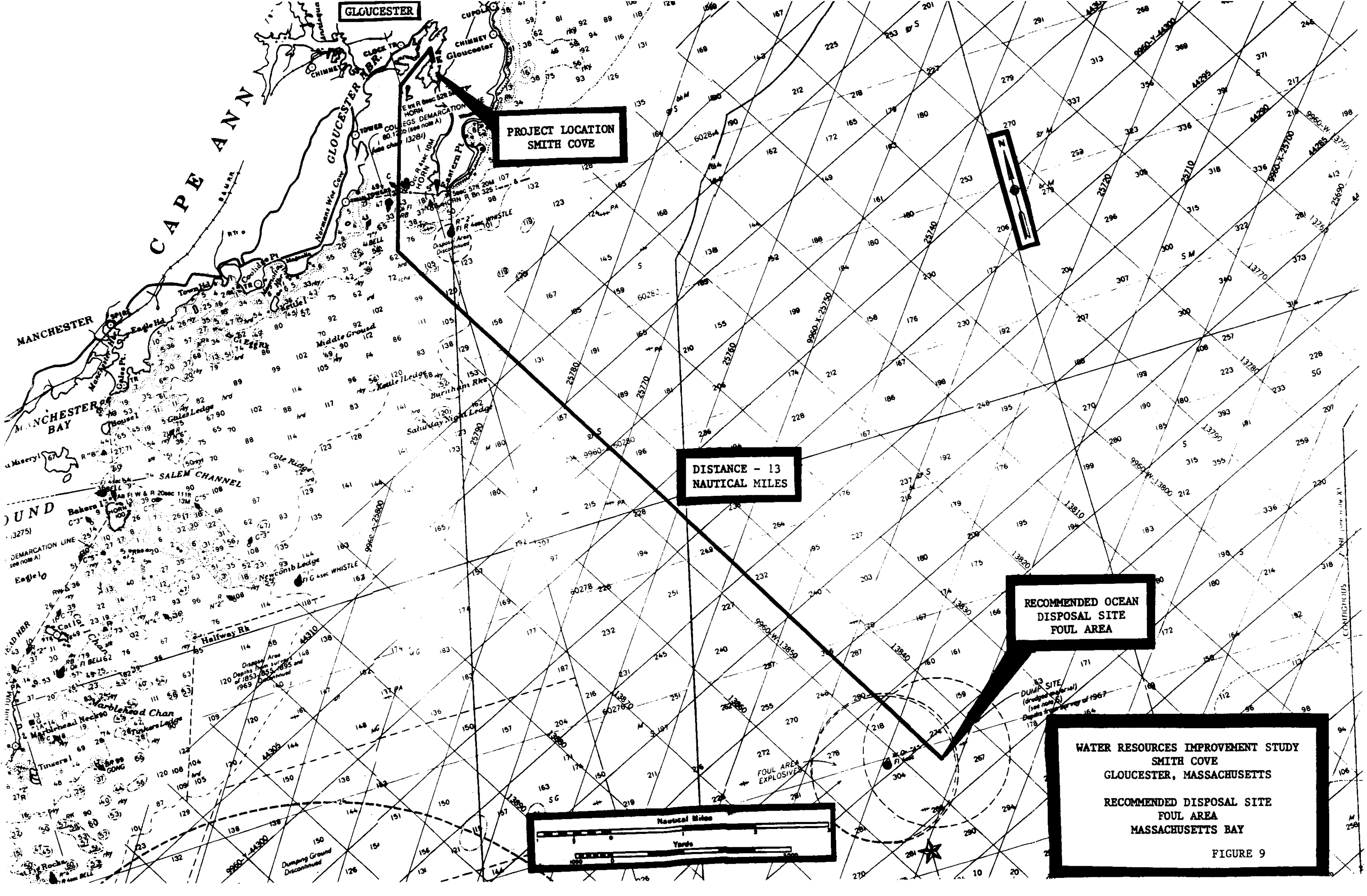
PIER
HOUSE
PIER
HOUSE
ATLANTIC OCEAN
SMITH COVE
LOCATION MAP
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
PLAN C
FIGURE 7



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

PLAN OF IMPROVEMENT AND
EXISTING FEDERAL PROJECT
IN INNER HARBOR

FIGURE 8



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

RECOMMENDED DISPOSAL SITE
FOUL AREA
MASSACHUSETTS BAY

FIGURE 9

TABLE 2

SMITH COVE, GLOUCESTER HARBOR
CONSTRUCTION COSTS OF DETAILED PLANS

FEDERAL CONSTRUCTION COSTS	PLAN A	PLAN B	PLAN C
Dredging	$282,000	$404,000	$562,000
Contingencies	56,000	81,000	112,000
Engineering and Design	20,000	20,000	21,000
Supervision and Administration	38,000	46,000	57,000
TOTAL FIRST COST	$396,000	$551,000	$752,000
Aids to Navigation	12,000	12,000	12,000
TOTAL IMPROVEMENT COST	$408,000	$563,000	$764,000
Interest During Construction	N/A	1,000	2,000
TOTAL INVESTMENT COST	$408,000	$564,000	$766,000

TABLE 3

SMITH COVE, GLOUCESTER HARBOR
ANNUAL COSTS OF DETAILED PLANS

ANNUAL COSTS	PLAN A	PLAN B	PLAN C
Interest and Amortization (8 7/8 % for 50 years) of Total Investment Cost	$37,000	$51,000	$69,000
Maintenance Dredging	6,000	9,000	12,000
Maintenance of Navigation Aids	2,000	2,000	2,000
TOTAL ANNUAL COSTS	$45,000	$62,000	$83,000

Project Benefits

Without additional mooring space in Gloucester Inner Harbor, commercial fishing operators will be displaced from the harbor. It was determined that due to the lack of sufficient onshore support facilities at nearby harbors, these fishermen would continue to off-load their catch in Gloucester. The additional transit time to and from their new home port will add approximately three hours of operating costs to the fishermen in order to harvest the same value of catch.

The plans of improvement carried through detailed planning generated quantifiable economic benefits to independent commercial fishing operators. By providing sufficient anchorage area in the inner harbor, displacement of the fishing boats is not necessary. The increase in operating costs is eliminated generating the project benefits. Benefits are calculated by determining the hourly operating costs of the affected vessels. This is then multiplied by the additional operating hours saved annually with project implementation. See Appendix 2, Social and Economic Effects Assessment, for a detailed examination of NED benefits derived from implementation of the proposed improvements.

Comparison Summary of Detailed Plans

A summary of project benefits compared to project costs for the three alternative plans of improvement are presented below in Table 4.

TABLE 4

SMITH COVE, GLOUCESTER HARBOR
ECONOMIC COMPARISON OF DETAILED PLANS

	PLAN A (6-FOOT)	PLAN B (8-FOOT)	PLAN C (10-FOOT)
Annual Benefits	$ 89,000	$119,000	$126,000
Annual Costs	$ 45,000	$ 62,000	$ 83,000
Benefit to Cost Ratio	2.0	1.9	1.5
Net Benefits	$ 44,000	$ 57,000	$ 43,000

ASSESSMENT AND EVALUATION OF DETAILED PLANS

Evaluation of the alternatives was based on their impacts on the environment, existing navigation, and social and cultural resources of the study area. The economic costs and benefits of project implementation have also been analyzed. Table 1 provides a comparison of the different features of the three plans.

Dredging Impacts

Dredging operations cause both short-term and long-term impacts. Short term impacts are related to construction activity and include a temporary increase in turbidity, a temporary release of objectionable odors when the dredged material is exposed to air, explosion impacts to fish during blasting of rock ledge and the noise impacts generated by construction equipment. Using a mechanical dredge will result in minimum disturbance of the material being removed. Bulk chemical and elutriate test results of the sediments to be dredged revealed no significant concentration or release of the chemical contaminants tested.

Removal of the dredged material may result in an objectionable sulfurous "rotten egg" odor. This odor is a natural product of the anaerobic bacterial breakdown of organic material in the bottom sediment. Sediment testing has indicated that the material contains primarily silts and clays with some organic material so that odors should be minimal and temporary.

Any removal of ledge will require underwater drilling and blasting. The over pressures generated by each explosion may result in up to 50% mortality of the fish within 30 meters of the blast site. The limited amount of rock to be removed and the seasonal timing of the blasting should minimize this impact.

Turbidity in the dredge area will be increased due to the dredging operation. Due to the method of dredging and the nature of the material however, this impact will be localized and temporary. Tidal flushing, settling of suspended materials and recolonization of benthic organisms will occur after the dredging operation ceases.

Construction activity will produce localized noise at the cove and along the route to the disposal site. Blasting noise should be minimal as the explosives are to be placed in bore holes in the rock and the overlying water will act to further buffer each explosion. Equipment noise impacts should also be minimized by scheduling the work activity during the winter months when tourism and outside activity levels are lowest. The winter schedule and working only during daylight hours should also minimize the disruption of local businesses, residences and traffic in the area.

Impacts include removal of benthic organisms within the dredge sediments and the changing of the physical character of the harbor and channel bottom. Removal of benthic organisms is an unavoidable result of dredging, however, recent studies in other estuary systems have shown these effects to be temporary. Motile species such as lobsters, crabs, and finfish should readily repopulate the area.

Dredging the anchorage was determined to impact approximately 2 acres of intertidal habitat. For this reason alternative environmental mitigation plans were developed with marsh restoration in the Gloucester/Annisquam River system recommended. Marsh restoration complies with the "no net loss" goal of Federal and State agencies. For a detailed description of the mitigation analysis refer to the Environmental Assessment section of this report.

A determination by the Massachusetts Historical Commission (see letter dated September 25, 1986 contained in Appendix 3, Pertinent Correspondence Received) stated that no significant cultural, historical, or archaeological resources exist in the proposed dredging or disposal area.

Construction of the proposed Federal navigation improvement project would increase the operating efficiency of the Gloucester commercial fishing fleet. This is accomplished by providing unobstructed access to greatly needed additional anchorage area in Smith Cove, Gloucester Inner Harbor.

Disposal Impacts

Both upland and ocean disposal options were evaluated. A report prepared for the Massachusetts Office of Coastal Zone Management identified sites within the Gloucester area for potential upland disposal. No acceptable upland sites were found in the area. The possibility of using the city landfill was investigated. Coordination with Gloucester officials determined that the city landfill was not a feasible option. Citing negative impacts including traffic, noise and air pollution impacts from trucks making an estimated 3,400 round trips through city streets hauling the dredged material, and damage to roads caused by truck traffic; city officials prefer the ocean disposal alternative.

Ocean disposal of the material to be dredged was evaluated. Based on the results of environmental testing of the material, it was determined to be acceptable for ocean disposal. Due to its engineering, economic, environmental and social acceptability, ocean disposal of the material to be dredged is recommended.

The material to be dredged from Smith Cove will be removed by a barge-mounted mechanical bucket dredge and placed in a scow. A tug will then tow the scow to the Foul Area, an EPA approved interim ocean disposal site, located approximately 13 nautical miles east of Gloucester. Disposal will occur by bringing the scow to a complete stop at a prescribed point, marked by a buoy placed by the New England Division.

The bottom dump discharge of the dredged material will occur in about 300 feet of water. The Foul Area has been and continues to be, extensively studied by the New England Division. Physical parameters such as currents, waves and tidal circulations have been closely monitored. Chemical and biological sampling and testing are also extensively studied. The Foul Area has been characterized as a low energy environmental suitable for dredged material disposal and containment.

A turbidity plume will be created by the disposal operation. Due to the method of dredging and disposal, and the natural cohesiveness of the dredged material, most of the material will remain consolidated. This impact on the water column at the disposal site will be temporary.

Physical, chemical and biological sampling and testing of the sediments to be ocean disposed were performed as part of this study. Results indicate that the material is ecologically acceptable for disposal at the Foul Area. No adverse comments regarding the impacts of the proposed ocean disposal activity have been received from local, state or Federal agencies. For further discussion of environmental impacts see the Environmental Assessment section of this report.

Economic Impacts

The economic impacts of the three alternative plans were evaluated for costs and benefits. The cost estimates (Table 2), as described in detail in Appendix 1, are based on the following factors: the quantity and type of dredged material, disposal costs, contractor mobilization and demobilization costs, equipment costs, project design (engineering and supervision) and administrative costs and contingencies. Charges for interest during construction (IDC) and for placement of required Aids to Navigation have been computed for the purpose of comparing benefits to costs and are not included in the cost apportionments.

For the purpose of determining the benefit to cost ratio, costs have been calculated to an annual cost over a 50 year amortization period using an interest rate of 8 7/8 percent at October 1989 price levels.

The benefits of the proposed plans of improvement, as described in detail in Appendix 2, are at October 1989 price levels and are based on the following assumptions :

- Elimination of increased operating costs due to displacement of nine independent commercial operators to nearby harbors by providing adequate anchorage area within Gloucester Inner Harbor, specifically Smith Cove, would result in a saving of labor and fuel costs for harvest of the existing catch.

- Benefits to the existing commercial fishing fleet would occur immediately following implementation of improvements.

- Alternative plans will not affect harvest rates or prices for commercial fish.

SELECTION OF A PLAN

The Selected Plan of Improvement

The selected plan of navigation improvement at Smith Cove for Gloucester Harbor, Gloucester, Massachusetts has been developed on consideration of economic efficiency, environmental acceptability, navigational safety and the problems, needs and objectives of local and state governments. Based on these parameters, Plan B results in the greatest net benefits and provides the most favorable plan for meeting the commercial fishing fleet. Plan B has been identified as the National Economic Development (NED) plan, and has been determined to not create significant negative environmental, cultural/historical, or social impacts to the region.

As shown in Figure 10, the selected plan will provide an access channel 800 feet long, 80 feet wide by 8 feet deep at mean low water along the west side of the Smith Cove to a 2.5 acre anchorage area dredged to 8 feet at mean low water at the south end of the cove.

Plan B requires the removal of approximately 33,000 cubic yards of ordinary material and 1,000 cubic yards of ledge rock. Construction of the selected plan of improvement should require approximately 6 weeks to complete and will be undertaken between the mid-October to end of March time frame.

Due to the environmental impacts of implementing the selected plan of improvement, the loss of approximately 2 acres of intertidal habitat, a mitigation plan of marsh restoration in the Gloucester/Annisquam River system is recommended and is included as part of the selected plan. The cost to implement the mitigation plan is included in the selected plan's construction costs.

The first cost of construction of the selected plan of improvement is $639,000. For the purposes of the benefit to cost analysis, interest during construction has been added to the first cost resulting in a total investment cost of $640,000.

Annual benefits derived from implementation of Plan B total $123,000. Annual costs including a 50 year amortization of the total investment cost, annualized maintenance dredging charges, and annualized maintenance of aids to navigation, amount to $66,000. Comparison of annual benefits and costs yields an annual net benefit of $57,000 with a benefit to cost ratio of 1.9. Figure 11 shows a comparative display of the alternative plan's net benefits. The alternative plans vary in quantity of material to be removed and length of construction. Impacts of the plans are virtually equal. This being the case, net benefits is the critical factor in determining the NED plan. Plan B achieves the greatest net benefits and hence, is identified as the NED plan.

Implementation Responsibilities

Cost Apportionment

Construction of the proposed plan of improvement will result in commercial navigation benefits only. No joint-use or separable recreational benefits exist.

The Federal and local cost sharing responsibilities for the first cost of construction, as stipulated in The Water Resources Development Act of 1986 (Public Law 99-662), require that the local sponsor contribute at least 20% of the first cost of construction. At least 10% of the first cost is to be paid during the construction period, and 10% may be paid over a period of time up to 30 years. The total local contribution would be $128,000, or 20% of the project first cost ($639,000). The remaining share of the first cost, $511,200, is the Federal contribution.

Federal Responsibilities

Federal responsibility includes its share of construction and 100 percent of future maintenance of the designated Federal channel and anchorage area.

Non-Federal Responsibilities

In accordance with the provisions of the Water Resources Development Act of 1986, the following is a list of items of local cooperation required for projects authorized under Section 107. The local sponsor must provide assurance that they intend to meet these items prior to project authorization.

- Assume full responsibility for all non-Federal costs associated with the project. Current statutes require that the non-Federal sponsor provide at least 20% of the first cost of construction.

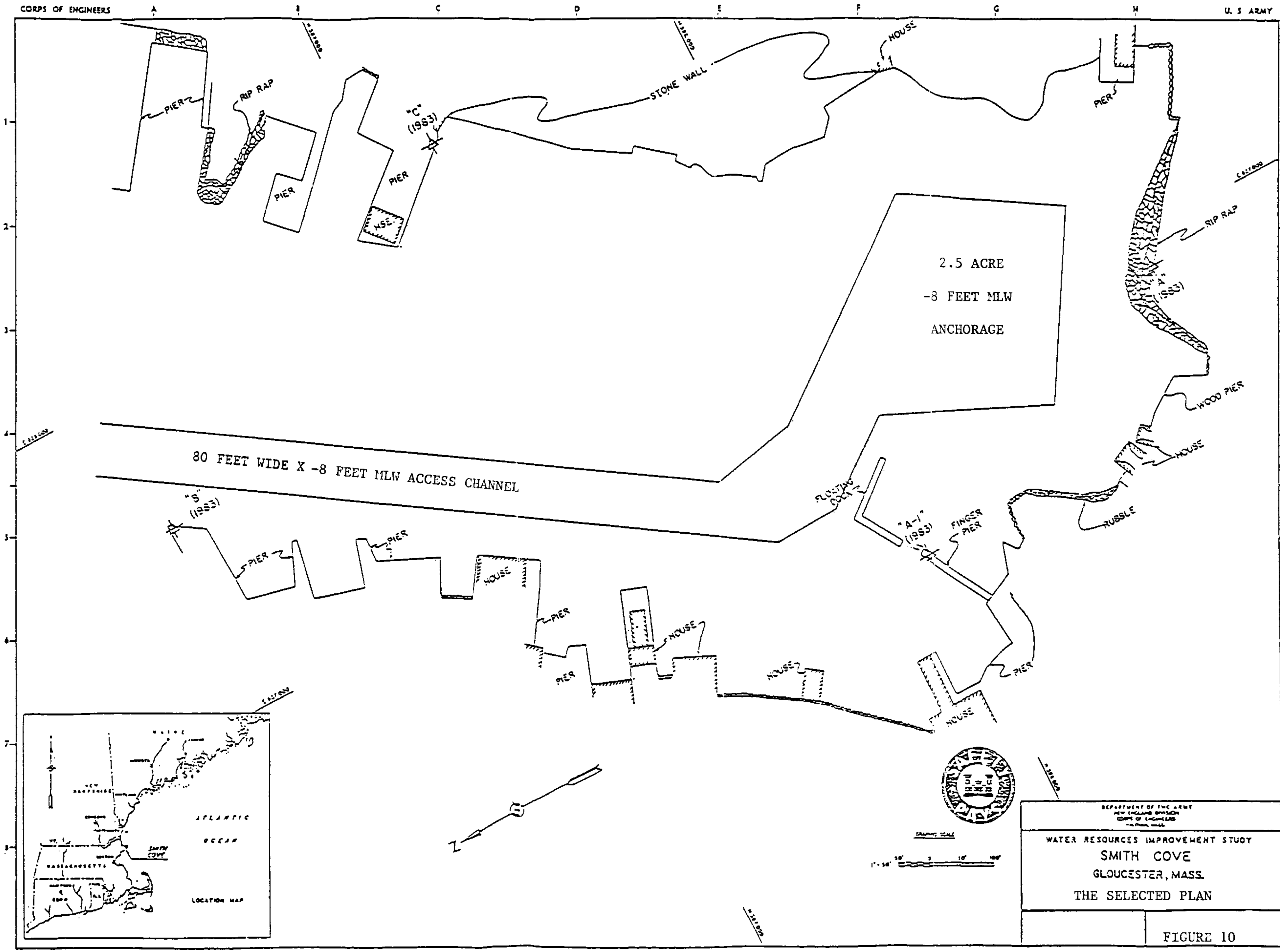
- Provide, maintain and operate without cost to the United States, an adequate public landing with provisions for the sale of motor fuel, lubricants and potable water, open and available to use for all on an equal basis.

- Provide, without cost to the United States, all necessary lands easements and rights of way necessary for project construction and subsequent maintenance, and acceptable disposal areas.

- Hold and save the United States free from damages that may result from construction and maintenance of the project.

- Provide and maintain mooring facilities as needed for transient and local vessels as well as necessary access roads, parking areas and other needed public use shore facilities open and available to all on an equal basis. Only minimum basic facilities and services are required as part of the project. The actual scope or extent of facilities and services provided over and above the required minimum is a matter of local decision. The manner of financing such facilities and services is a local responsibility.

- Provide a harbor management system that: makes no arbitrary distinction or requirement of any kind in allocating use of the project and ancillary facilities and services to the public except as may be consistent with the purpose for which the project was constructed; does not impose arbitrary fees or arbitrary variations in fees among users. The cost of providing necessary management and ancillary facilities and services may be offset through equitable user fees based on actual costs incurred. Information pertinent to harbor management, including but not limited to rules and regulations, lists of mooring holders, waiting lists and fee schedules, shall be readily available to the public at all times.


CORPS OF ENGINEERS
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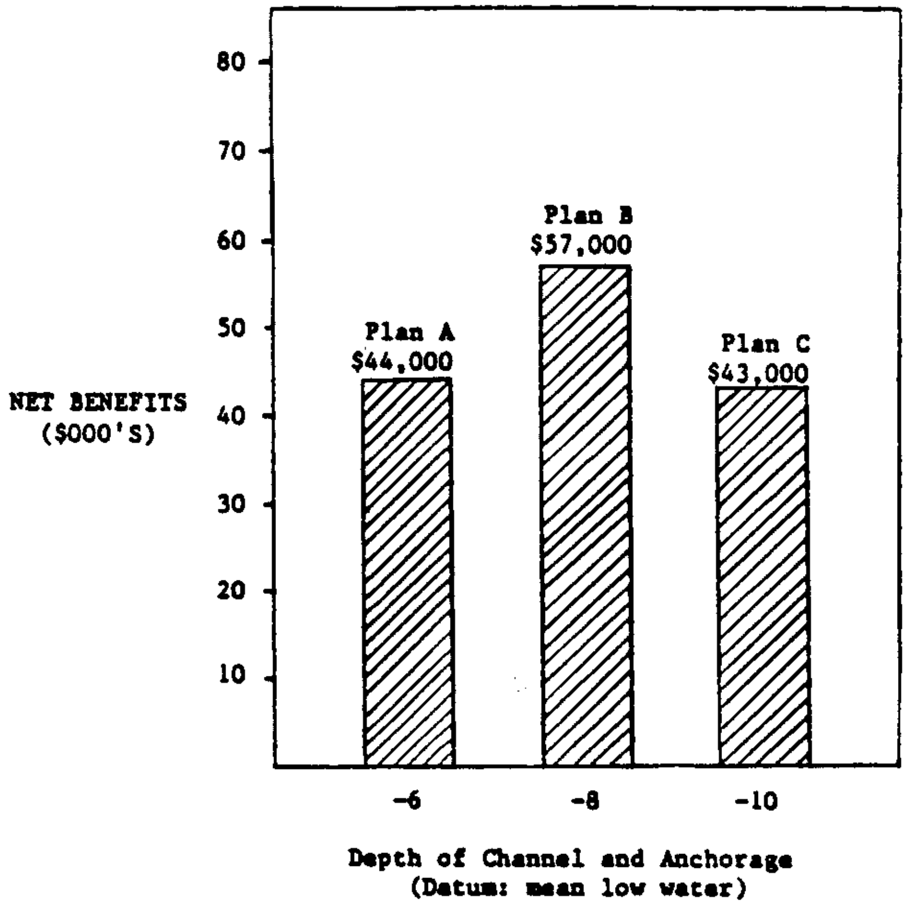
NEW HAMPSHIRE
MASSACHUSETTS
ATLANTIC OCEAN
SMITH COVE
LOCATION MAP
GRAPHIC SCALE
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
THE SELECTED PLAN
FIGURE 10



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS
COMPARATIVE DISPLAY
OF NET BENEFITS

FIGURE 11

CONCLUSION

The New England Division, Corps of Engineers, has reviewed and evaluated all pertinent data concerning the proposed plan for improving navigation at Smith Cove, for Gloucester Harbor. The Corps has received and evaluated the stated views of interested agencies and concerned public regarding the alternative plans. The possible consequences of each alternative have been evaluated on the basis of engineering feasibility, environmental impact and economic efficiency.

The recommended plan of improvement is Plan B described herein. Plan B, the NED plan, provides for an access channel 80 feet wide by 8 feet deep at mean low water, along the west, more commercially oriented side of Smith Cove. This channel would extend from the existing Federal anchorage at the entrance of Smith Cove to a 2.5 acre anchorage area to be dredged to 8 feet deep at mean low water at the south end of the cove. Disposal of the material to be removed for project implementation is recommended for the Foul Area, an EPA approved interim ocean disposal site located approximately 13 nautical miles east of Gloucester.

Implementation of the recommended plan was determined to impact approximately 2 acres of intertidal habitat. A mitigation plan calling for marsh restoration in the Gloucester/Annisquam River system, satisfying the "no net loss" goal of Federal and State agencies, is recommended. Final site identification would be determined during the Plans and Specifications phase of the Corps of Engineers study effort.

We find substantial benefits are to be derived by providing the commercial fishermen with reliable and safe access to a suitable anchorage area in Smith Cove. An Environmental Assessment has been prepared as part of this study. Although the proposed improvement would cause some disruption of the environment during dredging and disposal operations, these impacts have been addressed. The environmental impacts associated with the recommended plan are considered to be offset by the improvement and the resulting economic efficiencies realized.

The selected plan, as described in this report, is based on a thorough analysis and evaluation of various alternative courses of action for achieving the stated objectives. The selected plan is consistent with national policy, statutes, and administrative directives. This plan should best serve the interests of the general public.

The non-Federal project sponsor, the Commonwealth of Massachusetts, Department of Environmental Management, Division of Waterways, in cooperation with the city of Gloucester, fully supports the recommendation. In a letter dated May 10, 1989 the Division states its intention to meet their commitment by executing a Federal and State agreement for the project. At which time, the Commonwealth will enter into a mirror agreement with the city of Gloucester. The city of Gloucester, by letter dated October 20, 1989, states their concurrence with the study findings and their willingness and ability to finance their share of project costs for the Smith Cove, Gloucester Harbor, Gloucester, Massachusetts navigation improvement project.

RECOMMENDATIONS

I recommend that Plan B, as described herein for navigation improvement, be authorized for implementation as a Federal project, with such modifications as in the discretion of the Chief of Engineers may be advisable; at a first cost to the United States presently estimated at $511,000, and with annual operation, maintenance and replacement costs to the United States presently estimated at $66,000.

I have considered all significant aspects in the overall public interest including environmental, economic, and social effects, and engineering and financial feasibility in concluding that the NED plan of improvement described herein is the best implementable alternative achieving the objectives of this investigation subject to financial commitment.

The recommendations contained herein reflect the information available at this time and current Department policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and/or implementation funding.

1 March 1990
DATE

Daniel M. Wilson
DANIEL M. WILSON
Colonel, Corps of Engineers
Division Engineer

ACKNOWLEDGMENT AND IDENTIFICATION OF CONTRIBUTING PERSONNEL

This report was prepared under the supervision and management of the following New England Division personnel:

Colonel Daniel M. Wilson, Division Engineer
Joseph L. Ignazio, Chief, Planning Division
Nicholas E. Avtges, Chief, Plan Formulation Branch
John T. Smith, Chief, Coastal Development Section

The study and report were developed and prepared by Donald P. Birmingham, Study Manager. Study management team members contributing to the report are:

Michael Walsh - Coastal Engineering: Yuri Yatsevitch and Ron DeFilippo - Geotechnical Engineering: Ed O'Leary - Economic Analysis: Judi Johnson and William Hubbard - Environmental Assessment: Marie Bourassa - Cultural Resources.

Special appreciation is expressed to Ms. Mary Tsyver of the City of Gloucester's Harbormaster's office. Her assistance was vital in the development of this study and the recommended navigation plan of improvement.

DRAFT

LOCAL COOPERATION AGREEMENT

BETWEEN

THE DEPARTMENT OF THE ARMY

AND

THE COMMONWEALTH OF MASSACHUSETTS

FOR CONSTRUCTION OF THE

SMITH COVE, GLOUCESTER HARBOR,

NAVIGATION IMPROVEMENT PROJECT

GLOUCESTER, MASSACHUSETTS

THIS AGREEMENT, entered into this __________ day of _____, 19__, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), acting by and through the Commander, USAED New England Division, and the Commonwealth of Massachusetts (hereinafter referred to as "[the local sponsor]"), acting by and through its Department of Environmental Management,

WITNESSETH, THAT:

WHEREAS, the authority for the construction of the navigation project at Smith Cove, Gloucester, Massachusetts (hereafter called the "Project") not specifically authorized by Congress is contained in Section 107 of the River and Harbor Act of 1960, approved July 14, 1960 (PL 86-645), as amended; and,

WHEREAS, construction of the Project is described in a report entitled Smith Cove, Gloucester Harbor, Gloucester, Massachusetts prepared by the Division Engineer, US Army Engineer Division, New England, dated _______, and approved by the Chief of Engineers on ______________; and

WHEREAS, the Water Resources Development Act of 1986, Public Law 99-662, specifies the cost-sharing requirements applicable to the Project; and

WHEREAS, the local sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in project cost-sharing and financing in accordance with the terms of this Agreement;

NOW, THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS

For purposes of this Agreement:

1. The term "general navigation features of the project" shall mean the following project features assigned to commercial navigation: an access channel 80 feet wide by 8 feet deep at mean low water (MLW) along the west side of the cove, and dredging 2.5 acres of commercial anchorage at the south end of the cove to 8 feet below MLW.

2. The term "total cost of construction of general navigation facilities assigned to commercial navigation" shall mean all costs incurred by the local sponsor and the Government directly related to construction of the general navigation features of the project. Such costs shall include, but not necessarily be limited to, actual construction costs, costs of preparation of contract plans and specifications, costs of relocations not performed by or on behalf of the local sponsor, costs of applicable engineering and design, supervision and administration costs, and costs of contract dispute settlements or awards, but shall not include the value of lands, easements, rights-of-way, and dredged material disposal areas, relocations performed by or on behalf of the local sponsor, non-Federal dredging of public or private channels and berthing areas, aids to navigation, nor Government costs for preauthorization studies.

3. The term "period of construction" shall mean the time from the advertisement of the first construction contract to the time of acceptance of the general navigation features of the project by the Contracting Officer.

4. The term "Contracting Officer" shall mean the Commander of the U.S. Army Engineer Division, New England, or his designee.

5. The term "highway" shall mean any highway, thoroughfare, roadway, street, or other public road or way.

ARTICLE II - OBLIGATIONS OF PARTIES

a. The Government, subject to and using funds provided by the local sponsor and appropriated by the Congress, shall expeditiously construct the general navigation features of the project (including relocations or alterations of highway and railroad bridges), applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The local sponsor shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bids. The local sponsor also shall be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The Government will consider the views of the sponsor, but award of the contracts and performance of the work thereunder shall be exclusively within the control of the Government.

b. The Government shall operate and maintain the general navigation features of the project until the limit on Government participation, as set forth in paragraph i. of this Article, is reached.

c. The local sponsor shall provide and maintain, at its own expense, all project facilities other than those for general navigation, including dredged depths commensurate with those in related general navigation features in berthing areas and local access channels serving the general navigation features.

d. As further specified in Article III hereof, the local sponsor shall provide to the Government all lands, easements, and rights-of-way, including dredged material disposal areas, and perform all relocations or alterations of facilities other than utilities governed by paragraph e. below (except relocations or alterations of highway and railroad bridges), determined by the Government to be necessary for construction, operation, or maintenance of the project.

e. As further specified in Article III hereof, the local sponsor shall perform or assure performance of all utility relocations or alterations determined by the Government to be necessary for construction, operation, or maintenance of the project.

f. As further specified in Article VI hereof, the local sponsor shall provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation facilities assigned to commercial navigation:

1. 10 percent of the costs attributable to the portion of the project which has a depth not in excess of 20 feet;

g. As further specified in Article VI hereof, the local sponsor shall repay with interest, over a period not to exceed 30 years following completion of the project or separable element thereof, an additional 10 percent of the total cost of construction of general navigation facilities assigned to commercial navigation, depending on the value, as calculated under Arhicle IV hereof, of items provided pursuant to paragraph d. of this Article. If the credit allowed for such items is less than 10 percent of the total cost of construction of general navigation facilities, the local sponsor shall repay a percentage of said total cost equal to the difference between 10 percent of the total cost and the percentage of the total cost represented by the value of such items. If the credit allowed is equal to or greater than 10 percent of said total cost, the local sponsor shall not be required to repay any additional percentage of the total cost.

h. The local sponsor shall pay all project costs in excess of the Federal statutory cost limitation of $4,000,000. In no instance shall the Government's share of project costs, including preauthorization planning costs (reconnaissance studies, feasibility studies, etc.) exceed this limitation.

i. The Government's responsibility for operation and maintenance of the Project shall cease when the Government's expenditures for this responsibility have reached the greater of $4,500,000 less the Government's share of the construction costs of the general navigation features of the Project, or 125 percent of the Government's share of the construction costs of the general navigation features of the Project, both discounted on a present worth basis starting with the date the sponsor accepts the Project. The discount rate to be used in determining the value of future operation and maintenance expenditures will be the rate applicable to the evaluation of Federal water resource projects in the 1990 Federal Fiscal Year, 8 7/8 percent. In view of the non-Federal participation in the operation and maintenance of the Project, it is understood and agreed that the parties hereto will consult on necessity and frequency of maintenance. The Government, however, shall make the final decision on when maintenance shall occur during the period of Federal participation. When Federal participation ceases, the operation and maintenance of the Project becomes the responsibility of the local sponsor. The average annual cost for operation and maintenance of the Project is presently estimated to be $9,000, of which the Government's share is presently estimated to be $9,000.

j. No Federal funds may be used to meet the local sponsor's share of project costs under this Agreement unless the expenditure of such funds is expressly authorized by the granting agency.

ARTICLE III - LANDS, FACILITIES, AND RELOCATION ASSISTANCE

a. Prior to the advertisement of any construction contract, the local sponsor shall furnish to the Government all lands, easements, and rights-of-way, including suitable borrow and dredged material disposal areas, as may be determined by the Government to be necessary for construction, operation, and maintenance of the general navigation features, and shall furnish to the Government evidence supporting the local sponsor's legal authority to grant rights-of-entry to such lands.

b. The local sponsor shall provide or pay to the Government the full cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, determined by the Government to be necessary for construction, operation, or maintenance of the general navigation features.

c. Upon notification from the Government, the local sponsor shall accomplish all necessary alterations and relocations of buildings, highways, railroads, storm drains, and other facilities, structures, and improvements.

d. Upon notification from the Government, the local sponsor shall perform or assure performance of all necessary alterations and relocations of pipelines, cables, and other utilities. Except for projects authorized to be constructed to depths in excess of 45 feet, nothing herein shall be deemed to affect the ability of the local sponsor to seek compensation from other non Federal entities for costs it incurs under this paragraph. For projects authorized to be constructed to depths in excess of 45 feet, the cost of necessary alterations or relocations shall be shared equally between the local sponsor and the owner of the affected utility.

e. The local sponsor shall comply with the applicable provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved January 2, 1971, in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - VALUE OF LANDS AND FACILITIES

a. The value of the lands, easements, and rights-of-way to be credited toward the additional 10 percent of total costs the local sponsor must repay pursuant to Article II.g. will be determined in accordance with the following procedures:

1. If the lands, easements, or rights-of-way are owned by the sponsor as of the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the Project. The fair market value shall be determined by an Appraisal, to be obtained by the sponsor, which has been prepared by an independent and qualified appraiser who is acceptable to both the sponsor and the Government. The appraisal shall be reviewed and approved by the Government.

2. If the lands, easements, or rights-of-way are to be acquired by the sponsor after the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the project. The fair market value shall be deter mined as specified in subparagraph 1. above. If the sponsor pays an amount in excess of the appraised fair market value, it may be entitled to a credit for the excess if the sponsor has secured prior written approval from the Government of its offer to purchase such interest.

3. If the sponsor acquires more lands, easements, or rights-of-way than are necessary for project purposes, as determined by the Government, then only the value of such portions of those acquisitions as are necessary for project purposes shall be credited to the sponsor's share.

4. Credit for lands, easements, and rights-of-way in the case of involuntary acquisitions made within one year preceding the date this Agreement is signed or any time after the date this Agreement is signed will be based on court awards, or on stipulated settlements that have received prior Government approval.

5. For lands, easements, or rights-of-way acquired by the local sponsor within a five-year period preceding the date this agreement is signed, or any time after this agreement is signed, credits provided under this Article will also include the actual incidental costs of acquiring the interest, e.g., closing and title costs, appraisal costs, survey costs, attorney's fees, plot maps, and mapping costs, as well as the actual amounts expended for any relocation assistance provided in accordance with the obligations under this Agreement.

b. The costs of relocations or modifications of facilities (other than utilities) that will be credited towards the additional 10 percent of total costs the sponsor must repay pursuant to Article II.g. will be that portion of the actual costs incurred by the sponsor as set forth below:

1. Highways: Only that portion of the cost as would be necessary to construct substitute highways to the design standard that the State of Massachusetts would use in constructing a new highway under similar conditions of geography and traffic loads.

2. Facilities (Other than utilities): Actual relocation costs, less depreciation, less salvage value, plus the cost of removal, less the cost of betterments. With respect to betterments, new materials shall not be used in any relocation or alteration if materials of value and usability equal to those in the existing facility are available or can be obtained as salvage from the existing facility or otherwise unless the provision of new material is more economical. If, despite the availability of used material, new material is used, where the use of such new material represents an additional cost, such cost will not be credited to the sponsor's share.

c. No credit shall be given for any costs relating to relocations or alterations of utilities.

ARTICLE V - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the local sponsor and the Government during the term of construction the local sponsor and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the project.

b. The representatives appointed above shall meet as necessary during the term of project construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to the project, but the Contracting Officer, having ultimate responsiblity for construction of the project, has complete discretion to accept, reject, or modify the recommendations of the representatives.

ARTICE VI - METHOD OF PAYMENT

a. The local sponsor shall provide, over the term of construction, the percentages of the total cost of construction of general navigation facilities assigned to commercial navigation specified in Article II.f. hereof. Such cost is presently estimated to be $639,000. In order to meet its share, the local sponsor must provide an initial cash contribution presently estimated to be $64,000.

b. The initial cash contribution shall be provided as follows: 30 days prior to the award of the first construction contract, the Government shall notify the sponsor of its estimated share of project costs. Within 15 days thereafter, the sponsor shall provide the Government the full amount of the required contribution by delivering a check payable to "FAO, USAED, NEW ENGLAND DIVISION " to the Contracting Officer representing the Government. In the event that the total cost of construction of general navigation facilities assigned to commercial navigation is expected to exceed the estimate given at the outset of construction, the Government shall immediately notify the local sponsor of the additional contribution it will be required to make meet its share of the revised estimate. Within 15 days thereafter, the local sponsor shall provide the Government the full amount of the additional required contribution.

c. The Government will draw on the funds, provided by the local sponsor such sums as it deems necessary to cover contractuaL and in-house fiscal obligations attributable to the project as they are incurred, as well as project costs incurred by the Government prior to the initiation of construction.

d. Upon completion of the general navigation features and resolution of all relevant contract claims and appeals, the Government shall compute the total cost of construction of general navigation facilities assigned to commercial navigation and tender to the local sponsor a final accounting of its share of project costs. In the event the total contribution by the local sponsor is less than its initial required share of project costs at the time of the final accounting, the local sponsor shall, within 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet its initial required share of project costs. In the event`the local sponsor has made excess cash contributions which result in the local sponsor's having provided more than its initial required share of project costs, the Government shall credit the excess to the additional amount the local sponsor must repay pursuant to Articlef II.g. and II.h. of this Agreement.

e. The local sponsor shall repay the additional amount required pursuant to Article II.g. of this Agreement, reduced by any excess cash contribution made during the term of construction, in equal annual installments over a period of [not more than 30] years from the date the final accounting is tendered by the Government. Such repayment shall include intedest at a rate determined by the Secretary of the Treasury, taking into consideration the average market yields on outstanding marketable obligations of the United States with remaining periods to maturity Comparable to the repayment period, during the month preceding the fiscal year in which costs for the construction of the project are first incurred [or, in the case of recalculation, the fiscal year in which the recalculation is made], plus a premium of one-eighth of one percentage point for transaction costs. The interest rate shall be recalculated by the Secretary of the Treasury at five-year intervals. Nothing herein shall preclude the local sponsor from repaying this additional amount in full upon receipt of the final accounting. Should this full repayment be made within 90 days from receipt of the final accounting, there shall be no charges for interest or transaction costs.

ARTICLE VII - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

ARTICLE VIII - OPERATION AND MAINTENANCE

a. The local sponsor shall operate and maintain all portions of the project, except for general navigation features and aids to navigation, in accordance with regulations or directions prescribed by the Government.

b. The Government shall operate and maintain the general navigation features of the project as limited in Article II.i.

c. The local sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, repairing, and maintaining the project. If an inspection shows that the local sponsor for any reason is failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to the local sponsor. If the local sponsor persists in such failure for 30 calendar days after receipt of the notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the local sponsor owns or controls for access to the project for the purpose of completing, operating, repairing, or maintaining those portions of the project for which the sponsor is responsible under this Agreement. No completion, operation, repair, or maintenance by the Government shall operate to relieve the local sponsor of responsibility to meet its obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE IX - RELEASE OF CLAIMS

The local sponsor shall hold and save the Government free from all damages arising from the construction, operation, and maintenance of the project, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X - MAINTENANCE OF RECORDS

The Government and the local sponsor shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total project costs. The Government and the local sponsor shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the project and resolution of all claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE XI - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the local sponsor agrees to comply with all applicable Federal and state laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

ARTICLE XII - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - COVENANT AGAINST CONTINGENT FEES

The local sponsor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the local sponsor for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XV - TERMINATION OR SUSPENSION

a. If at any time the local sponsor fails to make the payments required under this Agreement, the Secretary of the Army shall terminate or suspend work on the project until the local sponsor is no longer in arrears, unless the Secretary of the Army determines that continuation of work on the project is in the interest of the United States. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations in amounts sufficient to meet project expenditures for the then current or upcoming fiscal year, the Government shall so notify the local sponsor. After 60 days either party may elect without penalty to terminate this Agreement or to suspend performance thereunder, and the parties shall conclude their activities relating to the project and proceed to a final accounting in accordance with Article VI.

ARTICLE XVI - NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage-prepaid), registered, or certified mail, as follows:

If to the local sponsor:

Mr. Gene Cavanaugh
Department of Environmental Management
Division of Waterways
349 Lincoln Street, Bldg. 45
Hingham, Massachusetts 02043

If to the Government:

Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

b. A party may change the address to which such communications are to be directed by giving written notice to the other in the manner provided in this section.

c. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at such time as it is personally delivered or on the third business day after it is mailed, as the case may be.

ARTICLE XVII - CONFIDENTIALITY

To the extent permitted by the law governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

THE DEPARTMENT OF THE ARMY	COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
BY:______________________ Division Commander	BY: ____________________
DATE: ______________	DATE: ________________
	APPROVED:____________________ Governor

CERTIFICATION OF AUTHORITY

I, ______________________, do hereby certify that I am Attorney General of the Commonwealth and that I have reviewed the agreement and that the Department of Environmental Management is a legally constituted public body with full authority and legal capability to perform the terms of the agreement between the United States of America and the Commonwealth of Massachusetts in connection with the Local Cooperation Agreement for the Smith Cove, Gloucester Harbor, Navigation Improvement Project, Gloucester, Massachusetts, and to pay damages, if necessary, in the event of failure to perform in accordance with Section 221 of Public Law 91-611, and that the person who has executed the contract on behalf of the Commonwealth of Massachusetts has acted within this statutory authority.

IN WITNESS THEREOF, I have made and executed this certificate this ______ day of ________________ 1989.

____
Attorney General of the
Commonwealth

CERITFICATION

I, ______________________________, do hereby certify that I am Secretary of the Commonwealth; ______________________ who signed this agreement on behalf of the Commonwealth, was then the Commissioner of the Department of Environmental Management, that said agreement was duly signed for and on behalf of the Commonwealth; and that Michael S. Dukakis was Governor of this Commonwealth on the date of approval of this agreement; and that __________________________ was Attorney General at the time of his approval.

____
Secretary of the Commonwealth

(SEAL)

Smith Cove
Gloucester Harbor
Gloucester, Massachusetts

ENVIRONMENTAL ASSESSMENT

SMALL NAVIGATION PROJECT ENVIRONMENTAL ASSESSMENT

SMITH COVE

GLOUCESTER, MASSACHUSETTS

Prepared by:

Judith L. Johnson
Wildlife Biologist

William A. Hubbard
Marine Ecologist

January 1990

Department of the Army
New England Division, Corps of Engineers
Waltham, Massachusetts 02254-9149

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I. INTRODUCTION AND PROJECT HISTORY

The New England Division of the Corps of Engineers has prepared an environmental assessment as part of the planning and development of the Smith Cove Small Navigation Project. This document was prepared in compliance with the National Environmental Policy Act of 1969 and appropriate environmental laws and regulations. It provides an assessment of the environmental impacts and alternatives for the proposed project and other applicable data with regards to Section 103 requirements.

This study was initiated under the authority and provisions of Section 107 of the 1960 River and Harbor Act, as amended. Study efforts were initiated in March 1981 as the result of a formal request by the Mayor and City Council of the city of Gloucester describing the urgent need for dredging in Gloucester Inner Harbor. A subsequent reconnaissance investigation, completed in April 1983, recommended a further detailed study be undertaken.

An existing Federal project, adopted in 1888 has been supplemented by enactments up until 1962. The project provides for a breakwater 2,250 feet long from Eastern Point over Dog Bar to Cat Ledge. The following elements constitute the Federal Navigation project:

1. An entrance channel into the Inner Harbor, 300 feet wide and 20 feet deep, with a turning basin 600 feet wide;
2. An access channel, 200 to 250 feet wide and 20 feet deep along the waterfront to the northwest of the Gloucester Fish Pier;
3. An access channel, 200 feet wide and 20 feet deep, along the waterfront southeast of the Gloucester Fish Pier;
4. An access channel, 650 to 300 feet wide and 16 feet deep extending into Smith Cove;
5. An access channel, varying from 500 to 100 feet wide and 18 feet deep, along the waterfront west of Harbor Cove into Harbor Cove;
6. An anchorage of about 5 acres, 15 feet deep, east of the entrance to Harbor Cove;
7. An anchorage of about 10 acres, 16 feet deep, opposite the entrance to Smith Cove;

Gloucester Harbor is in the process of revitalizing and redeveloping its waterfront and marine related activities. Smith Cove, located within Gloucester Inner Harbor, Gloucester, Massachusetts has been identified for potential development as a shallow water anchorage (Figure EA-1, Study Area) in an effort to free existing deep-water anchorage presently utilized by shallow draft vessels.

II. PROJECT DESCRIPTION

The proposed plan of improvement entails deepening about a 2.5 acre anchorage at the head of Smith Cove. An eight foot deep mean low water (MLW) anchorage would require removal of about 33,000 cubic yards of dredged material. Implementation of the project would include delineation of an access channel 80' wide and 8 feet deep at mean low water (MLW), from the Gloucester Inner Harbor to the anchorage in Smith Cove (See Figure EA-2, Environmental Sampling Locations).

To minimize interference with recreational activities and movement of boats in and out of the harbor, dredging is scheduled to take place within the period of mid October to the end of March. Dredging would be accomplished with a clamshell or bucket dredge over approximately a 5 week period. The sediments would be placed in scows and towed 13 nautical miles south to the Foul Area Disposal Site in Massachusetts Bay.

Three applications for Department of the Army permits have been received from persons residing around Smith Cove who desire to construct within the waterway. At site A, proposed is an extension of an existing pier in the southeast corner of Smith Cove and dredging of an area around the pier to allow greater accessibility. Approximately 2,000 cubic yards of material would be removed. The dredging portion of the project is to be performed in conjunction with the proposed Federal navigation improvement.

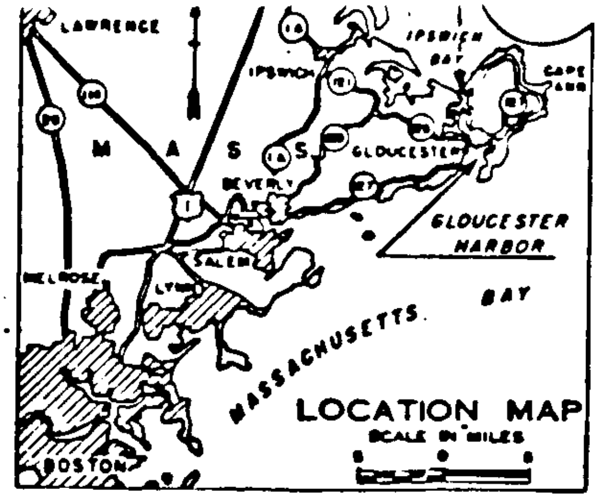
Site B, located in the southwest corner of the cove, proposes to dredge about 1,000 cubic yard of sediment again, as a "piggy-back" to the Corps' proposed dredging plan.

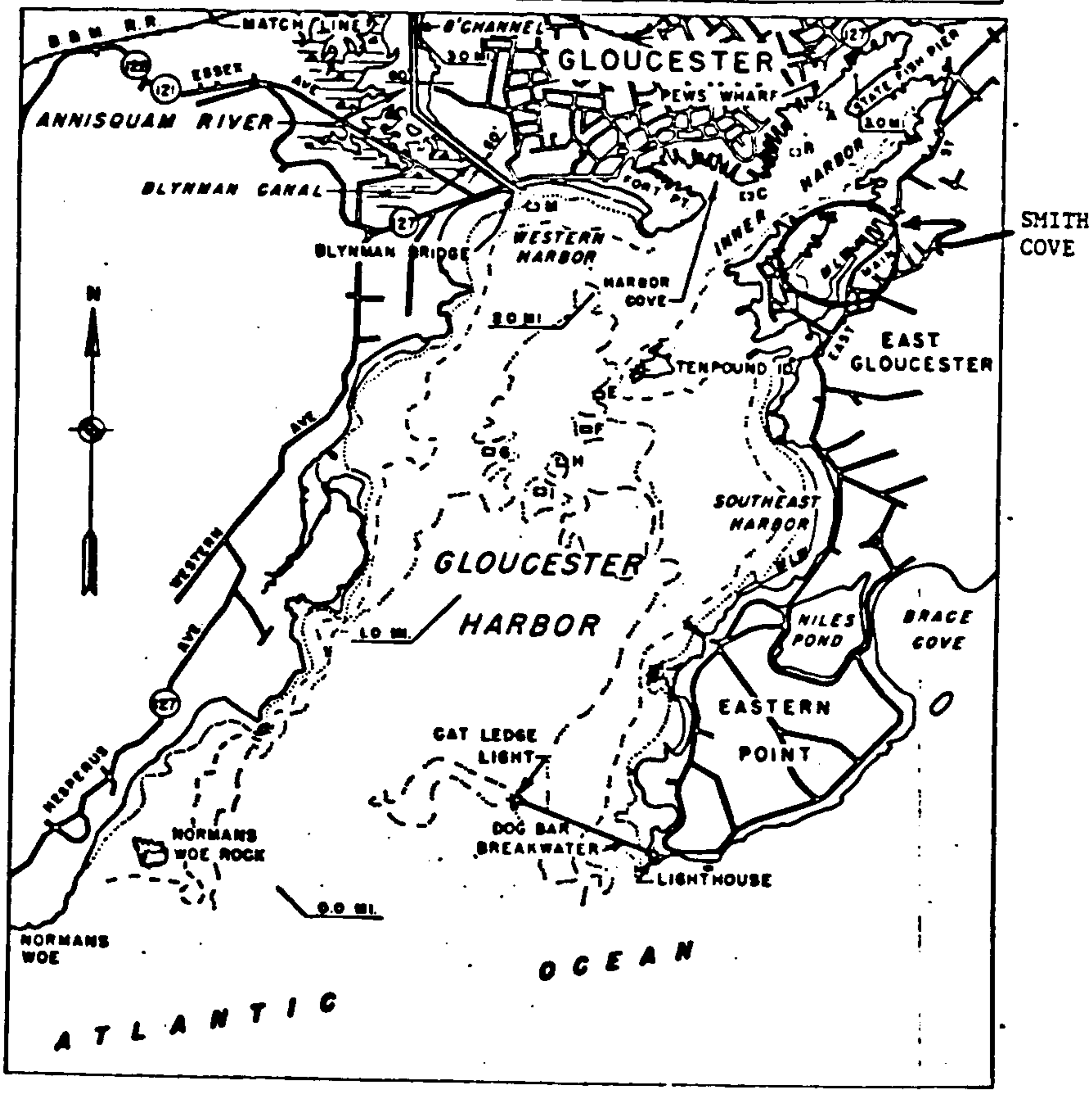
At Site C, plans are to extend a deck from an existing structure further into Smith Cove. The site is located along the west side of the cove and would extend no further than the Harbor Commissioner's Line.

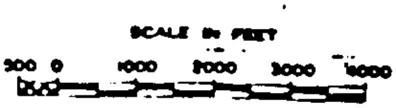
Although the privately proposed dredging is planned to "piggy-back" in the Federal navigation improvement plan, they are not in any way associated with the Federally proposed project in Smith Cove, and they will not interfere with design considerations.

III. PURPOSE AND NEED FOR THE PROJECT

The objective of the proposed project is to provide, by dredging, a shallow draft anchorage and area access channel in Smith Cove, located within the Gloucester Inner Harbor. The dredging would provide space for shallow draft vessels that, due to onshore development and the lack of existing mooring spaces, will be forced to relocate outside of Gloucester Harbor.



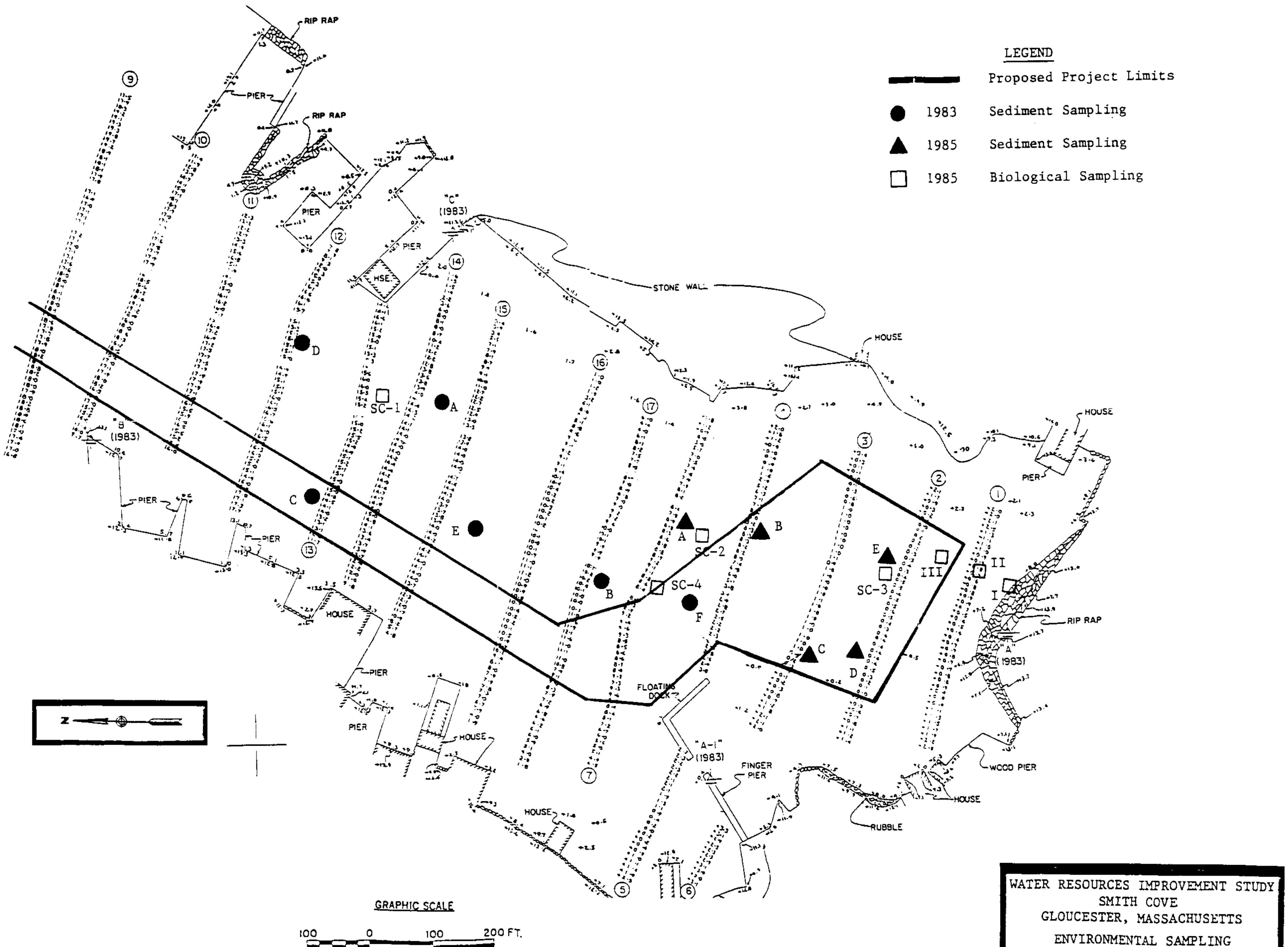




WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

STUDY AREA

FIGURE EA-1



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS
ENVIRONMENTAL SAMPLING
LOCATIONS EA-2

Local officials are currently in the process of revitalizing Gloucester Harbor waterfront and related marine activities. A number of shallow draft fishing vessels currently anchor in deep water areas in the vicinity of the Gloucester Fish Pier. In order to permit the fishing fleet to remain competitive and expand its activities, the proposed project would move small craft to newly created anchorage areas freeing existing deep water anchorage areas to accommodate immediate and future growth in the project area.

IV. ALTERNATIVES

The alternatives considered for this project include a non-structural alternative, a "no action" alternative, three alternative depth plans, and two disposal alternatives.

A. Alternatives (Including the Selected Plan)

1. Non-Structural

This alternative would involve transferring excess existing commercial fishing activities to nearby ports which have adequate protection and capacity under existing conditions. The ports of Manchester, Rockport, and Ipswich are relatively close to Gloucester Harbor. Logistical problems, such as overcrowding in neighboring harbors, would undoubtedly hamper efforts in trying to carry out a transfer plan. In addition, economic constraints such as the increased cost incurred by greater travel distances and loss of existing and future revenue generated as a result of commercial fishing activity in Gloucester Harbor greatly reduces the feasibility of this non-structural alternative. Therefore, this alternative was eliminated from further study.

2. No Action

Should no additional Federal improvements be undertaken in Gloucester Harbor there would be a number of short and long term impacts upon the community. Onshore development would force some fishing boats out of the harbor due to a lack of available mooring space. At Gloucester Harbor, many fishermen are increasing the variety of species they catch in order to remain competitive in the industry. These diversified operations require larger, modern vessels with a longer range to reach the finfishing grounds and deeper drafts to enable fishermen to land a larger catch per trip. Short term impacts would be curtailed fleet expansion and modernization as there would be no additional mooring space to allow new deep draft vessels in the harbor. With fleet expansion limited to existing conditions, the fleet might actually grow smaller over the long term, as only larger craft remained competitive and the support facilities become dilapidated through lack of capital investment. Overall, maintaining current conditions would probably lead to a gradual reduction in Gloucester's importance as a major fishing port. Therefore, the no action alternative was not considered a viable alternative.

3. Dredge to Depths of -6 feet MLW

This alternative consists of dredging a 2.5 acre anchorage to a depth of -6 feet MLW at the head of Smith Cove in Gloucester Inner Harbor. This would require removal of approximately 22,300 cubic yards of predominantly silt/clay material. There is a possibility of encountering ledge which would require removal of up to 540 cubic yards of rock. The material would be removed with a clamshell dredge loaded into scows and towed 13 nautical miles south to the Foul Area Disposal Site. Implementation of the plan would require delineation of an access channel 80 feet wide and at least 6 feet deep at MLW from the Gloucester Inner Harbor to the anchorage at Smith Cove.

The environmental impacts associated with the plan would include increased suspended sediments during dredging operations and the destruction of benthic organisms in Smith Cove. It was determined that the anchorage depth of -6 feet is not sufficient for the physical characteristics of the fleet. This would create operating inefficiencies due to tidal delays. Therefore, this was not considered a viable alternative.

4. Dredge to Depths of -8 Feet MLW (Selected Plan)

This alternative consists of dredging a 2.5 acre anchorage to a depth of -8 feet MLW at the head of Smith Cove in Gloucester Inner Harbor. This would require removal of approximately 33,000 cubic yards of predominantly silt/clay material. There is a possibility of encountering ledge which would require removal of up to about 1,000 cubic yards of rock. The material would be removed with a clamshell dredge, loaded into scows and towed 13 nautical miles south to the Foul Area Disposal Site. Implementation of the plan would require delineation of an access channel 80 feet wide and at least 8 feet deep at MLW from the Gloucester Inner Harbor to the anchorage of Smith Cove.

The environmental impacts associated with this plan would include increased suspended sediments during dredging operations and the destruction of benthic organisms in Smith Cove. This plan would provide additional anchorage beneficial to nine commercial fisherman. These impacts are addressed in the contents of this environmental assessment.

5. Dredge to Depths of -10 Feet MLW

This alternative consists of dredging a 2.5 acre anchorage to a depth of -10 feet MLW at the head of Smith Cove in Gloucester Inner Harbor. A 10 foot anchorage would require removal of approximately 46,000 cubic yards of predominantly silt/clay material. There is a possibility of encountering ledge which would require removal of up to about 1,800 cubic yards of rock. An 80 foot wide by 10 foot deep at MLW access channel servicing the anchorage is proposed.

Impacts of this plan would include suspended material in Smith Cove during dredging and at the disposal site during disposal operation and destruction of the benthic community in disrupted areas. It would provide an additional deep draft anchorage however, based on fleet characteristics, an -8 foot MLW depth anchorage was considered adequate to fulfill the objective of this project. Therefore, this was not considered a viable alternative.

B. Alternative Methods of Disposal

1. Foul Area Ocean Disposal Site (Selected Plan)

At the present time, the closest Environmental Protection Agency (EPA) designated ocean disposal site is the Foul Area in Massachusetts Bay (Environmental Protection Agency, 1977). The Foul Area is two nautical miles in diameter and is located 14 1/2 nautical miles southeast of Manchester Bay with its center at latitude 42°25.7' N, longitude 70°34' W (See Figure EA-3, Foul Area, Massachusetts Bay). This site has a history of being used for the disposal of dredged materials and industrial wastes. Disposal would be acceptable provided ocean dumping requirements of the Marine Protection Resources and Sanctuaries Act are met based on sediment analysis and bioassay and bioaccumulation tests.

2. Alternative Disposal Sites

Upland disposal for dredged material was considered during this study. Sasaki Associates, Inc. prepared a report entitled Upland Dredge Material Disposal Site Analysis" in 1983 for Massachusetts Office of Coastal Zone Management. Sasaki Associates, Inc. identified four areas within a 2 mile radius of Gloucester Inner Harbor as potential upland disposal sites. Three of the sites were not viable as a result of economic and environmental constraints except for Site G-4 (See Appendix I).

Site G-4 is an open water area behind the Dogbar Breakwater located on the Eastern Point at the entrance to Gloucester Harbor. Discussions with local officials determined that this site is currently used to harvest lobster, and to open moor commercial fishing boats and recreational craft. Officials expressed concern over using this site and prefer the Foul Area ocean disposal site. For these reasons, no further investigation as to this site's feasibility was pursued.

The city owned upland landfill was identified during the study as a potential disposal site. Dredged material would either be stockpiled, diked and dewatered at Smith Cove or stockpiled and dewatered at the landfill. The material would be transported by trucks (traveling about 5 miles) through city streets to the landfill. Based on a 10 cubic yard truck capacity, approximately 3,400 round trips would be required. Social impacts associated with this alternative include; increased traffic congestion and associated noise and air pollution; and damage to roadways from intensive use by large trucks.

In consideration of these impacts, local officials prefer disposal of the dredged material at the Foul Area ocean site. In addition, the landfill was scheduled for closing on June 30, 1987 and no alternative upland landfill sites were identified. Dredging of Smith Cove would not occur until after the landfill is closed. Therefore, the city owned landfill was not a viable alternative.

V. AFFECTED ENVIRONMENT

A. Dredge Site

1. General

Smith Cove is a small, rectangular-shaped body of water, about 820 feet wide and 1,300 feet long located at the head of Gloucester Harbor, Massachusetts at 42° 36' north latitude by 70° 40' west longitude. By water, Gloucester Harbor is located approximately 37 miles northeast of Boston. The cove was created by connecting a causeway on an intertidal bar between East Gloucester and Rocky Neck, formerly an island in Gloucester Harbor. The surrounding land use includes private and commercial anchorage and docking facilities and other water dependent and nondependent commercial enterprises. The cove is surrounded by fishing piers, marinas, restaurants, a large parking lot and a few private residences.

Smith Cove is a well protected bay connected to the Inner Harbor on its northern side. The highest elevation is about 80 feet above mean high water (MHW) on the eastern shore (East Gloucester). The inner (southern) part of the Cove is intertidal and consists of a four acre tidal mud flat at MLW. The rest of the Cove deepens in a northerly direction down to about 18 feet at mean low water. The Cove's sediments are predominantly silt and clay mixed with sand, gravel and cobble-size rocks. Organic detritus is also commonly found in the upper 20 cm of sediment.

Smith Cove is protected from direct wave action by its particular orientation to Gloucester Inner Harbor and surrounding upland topography. Little information exist specific to Smith Cove, however, tidal velocity near the entrance to Smith Cove was calculated to be in the order of 2 cm/sec (0.04 knot) (Sanford Ecological Services 1985). This would not be expected to increase considering the small size of Smith Cove as compared to Gloucester Harbor and the sheltering of wind by buildings and topography. Maximum flood is 154.3 cm/sec (3.0 knots) at 310° northwest and maximum ebb is 170.0 cm/sec (3.3 knots) at 130° southeast in Gloucester Harbor (N.O.A.A 1986). Gloucester Harbor has a mean tide of 2.61 meters and a spring tide of 3.03 meters.

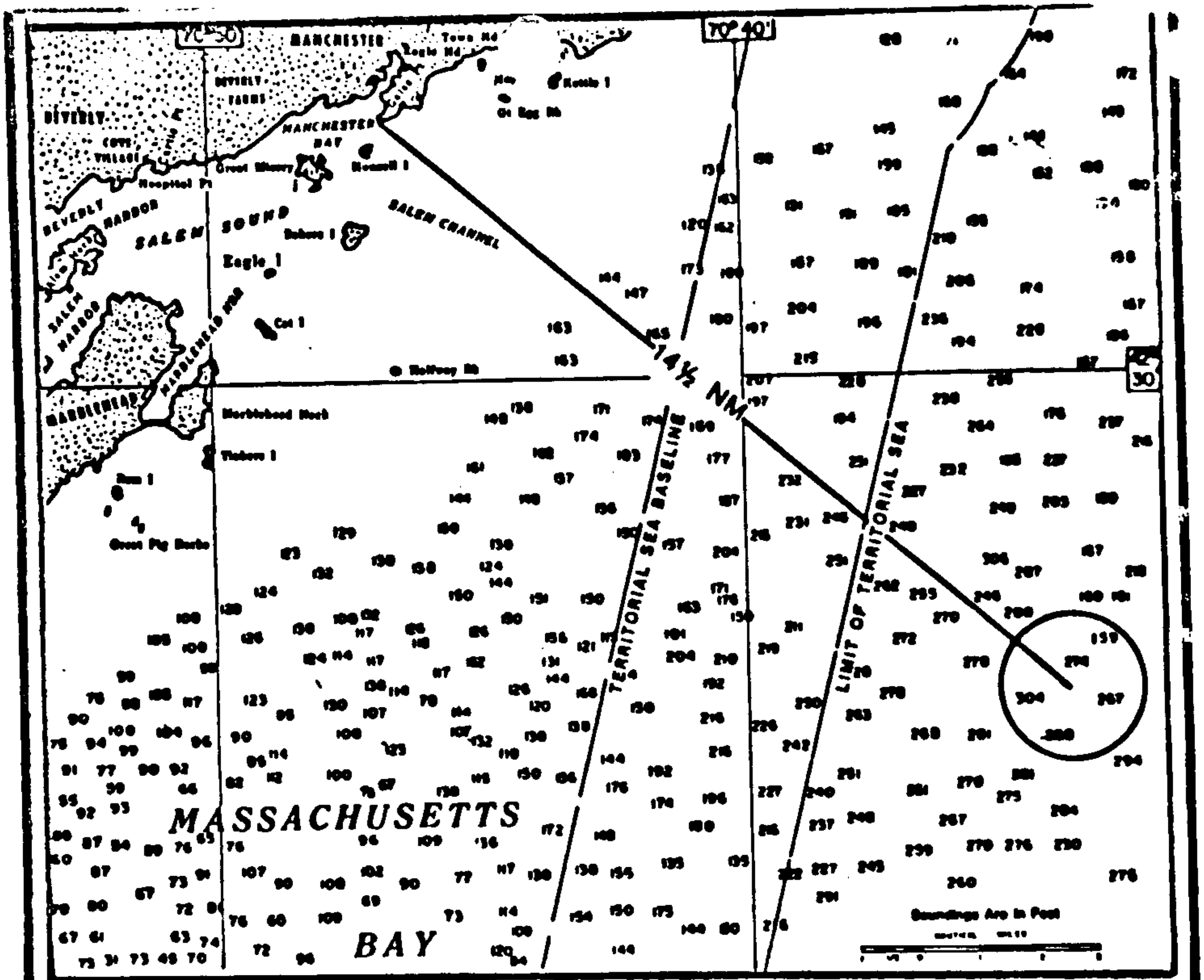
2. Physical and Chemical

Initial bulk sediment samples were obtained by New England Division (NED) in 13-15 September 1983 at six locations (A through F) in Smith Cove, Gloucester Harbor, Massachusetts (See Figure EA-2, Environmental Sampling Locations). Sediment cores were collected at all sites. Sites A, B, and C were selected for elutriate testing. Due to revisions in the configuration of the project boundary only one site, "F", was found to be

WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

PROPOSED
DISPOSAL SITE

FIGURE EA-3



FOUL AREA DISPOSAL SITE

Description: This site is a circular area with a diameter of 2 nautical miles and center at 42°-25.7'N, 70°-34.0'W. From the center, the Marblehead Tower bears true 282° at 24,300 yards and Baker Island Horn bears true 300° at 24,300 yards. The authorized disposal point (within the overall disposal area) is specified for each dredging project in other project documents. Depth Range: 159 to 304 feet MLW

NOTE: The map depicts the disposal site's location in relation to landmarks. It is not intended for use in navigation.

within the dredging boundary. Additional sampling was performed in Smith Cove by NED on 28 and 29 August 1985 to include all of the proposed dredged area. Five additional sample points were located (A through E) within the delineated dredging boundary. Sediment grabs were collected at all sites. Sites A and E were selected for elutriate testing. In 1988, the configuration of the channel was changed again which resulted in sample point A being located outside of the dredging boundary. However, this sample is close to the delineated boundary and is still considered representative of the characteristics of potential dredge material. Therefore, sample point A is included in the analysis of potential environmental impacts of the proposed project.

Generally, the Smith Cove 1983 (Appendix II) and 1985 (Appendix III) bulk sediment testing yielded similar results. According to the Massachusetts Division of Water Pollution Control (1978) regulations for classification of dredge or fill material, sediments in Smith Cove encompassed all sediment physical characteristics (Type A, B, and C) and all categories (Category I, II and II) of chemical constituents. These criteria are outlined in Table EA-1 on the following page. Sediments in Smith Cove consist of predominantly silt and clay. Chemical analysis also showed elevated levels of lead, zinc, copper, and oil and grease in the upper 0.25' of sediment. Because the 1983 data was outside the project boundary the following analysis will concentrate on the 1985 bulk sediment results and elutriate tests as a more accurate representation of proposed dredge material.

TABLE EA-1

Massachusetts Division of Water Pollution Control
Classification of Dredged or Fill Material
By Chemical Constituents
All units are in parts per million

	Category One	Category Two	Category Three
Arsenic (As)	< 10	10-20	> 20
Cadmium (Cd)	< 5	5-10	> 10
Chromium (Cr)	< 100	100-300	> 300
Copper (Cu)	< 200	200-400	> 400
Lead (Pb)	< 100	100-200	> 200
Mercury (Hg)	< 0.5	0.5-1.5	> 1.5
Nickel (Ni)	< 50	50-100	> 100
Polychlorinated Biphenyls (PCB)	< 0.5	0.5-1.0	> 1.0
Vanadium (V)	< 75	75-125	> 125
Zinc (Zn)	< 200	200-400	> 400

Category One materials are those which contain no chemicals listed in concentrations exceeding those listed in the first column.

Category Two materials are those which contain any one or more of the chemicals in the concentration range shown in the second column.

Category Three materials are those materials which contain any chemical listed in a concentration greater than shown in the third column.

Classification of Dredged or Fill Material
By Physical characteristics

	Type A	Type B	Type C
Percent silt-clay	< 60	60-90	> 90
Percent water	< 40	40-60	> 60
Percent volatile solids (NED Method)	< 5	5-10	> 10
Percent oil and grease (hexane extract)	< 0.5	0.5-1.0	> 1.0

Type A materials are those materials which contain no substances listed exceeding the amounts indicated in the first column.

Type B materials are those material which contain any one or more of the substances listed in the concentration range shown in the second column.

Type C materials are those materials which contain any substance listed in a concentration greater than shown in the third column.

Bulk sediment analysis of the 1985 sediment samples showed physical characteristics classified as Type A, B, and C. Station A was described as dark gray organic sandy silty clay with shell fragments consisting of 80% fines. Station B was described as black organic silt clay (90% fines) and Station C consisted of 63% fines being black olive gray organic silty clay with shell fragments. Station D and E showing the least fines at 53% and 48% respectively, and were described as black organic sandy clayey silt with shell fragments and black olive gray organic silty coarse to fine sand with trace gravel, respectively. These two points (D and E), showing the least fines are located closest to shore, reflective of the effects of sediment loading. Type B levels of oil and grease were identified at sample point B however, average over the five points equaled Type A at 3218 ppm (S.D. 2373.2). Average percent volatile solids concentration was 7.26% (S.D. 2.80) which is categorized as Type B sediment.

At the present time, Gloucester Harbor, including Smith Cove, is classified as SB (MWRC, 1978). Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation, and for shellfish harvesting with depuration (MWRC, 1978). At the present time the inner harbor from Ten Pound Island inward is closed to all shellfishing due to contamination. Although swimming and wading are permitted, the presence of extraneous matter and impurities, particularly in the inner harbor, preclude such activities. The present water quality conditions in Smith Cove are largely due to the discharge of primary sewage effluent and waste waters from processing firms (U.S. EPA, 1982 in Sanford Ecological Services, 1985).

A limited water quality monitoring program within Smith Cove has been conducted since June 1982 by Resources for Cape Ann. The data collected as part of this program indicates that low dissolved oxygen concentrations occur on a regular basis during the summer months. These low levels occur most noticeably after a heavy rainfall, when storm runoff combines with municipal sewage in the city's combined sewer system and flows directly into the inner harbor; also, after southeast winds blow sewage-laden water from the outer harbor to the inner harbor (Sanford Ecological Services, 1985).

The 1985 bulk sediment analysis (See Appendix III) identified Category III lead in all samples (A through E); average value was 317.0 ppm (S.D. 77.9). Category III levels of zinc were identified at sample points C, D, and F. Zinc concentrations averaged to be Category II over all sample points at 292.8 ppm (S.D. 76.1). Category II copper was identified at A, C, D, E. Arsenic of Category II concentration were identified for single replicates at sample points C and D however, the average value was calculated to be Category I at 0.80 ppm (S.D. 0.14). PCB levels (averaged value was 0.097 ppm, S.D. 0.02) did not appear to be significant, i.e. Category I.

Dredge site water was collected as part of the elutriate test program in Smith Cove. Ambient conditions for copper (27.5 ppb) exceeded EPA 1985 Water Quality Criteria of 2.9 ppb. Ambient conditions for PCB's (0.05 ppb) also exceeded EPA 1980 Water Quality Criteria of 0.03 ppb (See Appendix VII for 1985 Elutriate Test Results).

Bulk sediment data showed the physical characteristics of Smith Cove sediments to be predominantly silt/clay, consisting of a high percentage of fines. Generally, sediments are coarser southward as smaller particles (silt and clay) are carried further into the harbor. The analyses of sediment chemical constituents showed high levels of lead, moderate to high levels of zinc, moderate levels of copper and moderate levels of oil and grease. In addition, there are elevated levels of copper and PCB's in existing water quality conditions. Increased use of New England harbors for commercial and recreational boating is the most likely cause for the contamination. Paint from boats, oil, gas, metal work and combined sewer overflows has resulted in the release of contaminants into the estuarine ecosystem and subsequent incorporation into the upper layers of the benthos.

3. Biological

The estuarine environment of Smith Cove includes intertidal habitat, subtidal habitat and a small tidal marsh located in the southeast corner of the cove. The area is used by a variety of avispecies including, herring gulls, black-backed gulls, cormorants, and common egrets. Finfish species found in Smith Cove include winter flounder (Pseudopleuronectes americanus) and yellowtail flounder (Limanda ferruginea), Atlantic silversides (Menidia menidia), sticklebacks (Gasterosteidae spp.) and mummichogs (Fundulus heteroclitus) (U.S. Fish and Wildlife, 1986, See Correspondence Section). Lobster (Homarus americanus) are seasonal foragers to nearshore embayments but are not expected in large numbers in the proposed project sites, preferring subtidal rocky crevices.

Terrestrial wildlife in areas surrounding Smith Cove are those species well adapted to an urban environment. Terrestrial habitat consists of a few trees in residential areas that boarder Smith Cove. Eastern gray squirrels (Sciurus carolinensis), starlings, English sparrows and pigeons are common in the relatively urban setting of Gloucester.

The tidal marsh is composed of tall salt marsh cordgrass (Spartina alterniflora) on the outer edges with salt meadow cordgrass (Spartina patens) in the center. The aquatic macrophyte flora of Smith Cove is dominated by rock weed (Fucus vesiculosus) which attaches to the riprap at the south end of the cove. In addition, sea lettuce (Ulva lactuca) covers the entire southern end of the cove during summer months.

Quantitive benthic sampling was performed by New England Division, Army Corps of Engineers on 13 August and 22 August 1986 in the subtidal and intertidal habitat in Smith Cove. Methodology and results of this sampling are contained in the Biological Report (See Appendix IV). The following discussion summarizes this report.

The dominant benthic species for station SC-1, located approximately 150' east of the proposed access channel to the anchorage area, was the tube dwelling, deposit feeding polychaetes Capitella capitata (98.7% of all individual recovered). Station SC-2, located just slightly east of the project boundary also showed Capitella capitata as the extreme dominant representing 97.0% of all individuals recovered. Station SC-3 exhibited low numbers of organisms present (137.5 organisms per square meter) with dominance shared by Capitella capitata, (36.4%) Jaera marina (22.7%), Mya arenaria (13.6%) and Littorina littorea (9.1%). Station SC-4, located on the proposed project boundary also showed the extreme dominant to be Capitella capitata (95.7%).

The polychaeta Capitella capitata represents 93.3% of all organisms recovered in subtidal habitat in Smith Cove. This organism is known to withstand numerous environmental stresses. Many of the other species present, e.g. Streblospio benedicti, Peloscolex benedeni and Polydora ligni, are tolerant of low oxygen levels and an abundance of particulate organic matter. These assemblages of species are typical inhabitants of urban estuaries. Their presence may be attributed to chemical stresses, the settling of large amounts of organic matter, depletion of available water column oxygen due to increasing water temperatures, local algal blooms and/or an increase of a chemical oxygen demand.

Intertidal sampling was accomplished by establishing three stations along a transect preceding from high (Station I) intertidal to low intertidal (Station III) (See Figure EA-2). All epifaunal organisms in 20 cm by 20 cm grid and were identified and enumerated. Additionally, 4 replicate one liter hand cores were obtained at each station. These benthic samples were sieved through a 0.5mm screen, stained, preserved and identified. This transect can be considered qualitatively applicable to any similar transect through the intertidal area at the southeastern end of Smith Cove.

Codominant benthic fauna in Station I, (high intertidal) included; Streblospio benedicti, Capitella capitata, Polydora ligni and Oligochaeta sp. A small percentage of the commercially important blue mussel, Mytilus edulis and the clam, Mya arenria, were present. At midtidal level (Station II), Streblospio benedicti (91.5%), Mya arenria (2.6%) and Oligochaeta spp. (2.6%) were the dominant organisms. At Station III, the benthic community most likely to be impacted by the proposed dredging, the dominant organisms were Capitella capitata (65.3%), Peloscolex benedeni (19.0%), Streblospio benedicti (40.0%), Microdeutopus gryllotalpa (3.9%) and the Oligochaeta spp. (3.2%).

The dominance of Streblospio benedicti, Capitella capitata and oligochaetes indicate the intertidal area of Smith Cove is stressed by physical, chemical or biological factors. The substrate consists of fine detrital particles accumulated among silt/clay sediments. This organically enriched environment stresses the available oxygen concentrations of the habitat. In an environment subject to oxygen depletion, the tube dwelling and surface feeding pioneering organisms (e.g. Streblospio benedicti and Capitella capitata) proliferate, especially as bacterial metabolism generates a hydrogen sulphidic and anerobic substrate.

Approximately 1.8 acres of intertidal habitat (which includes 1.5 acres impacted directly by the dredge and 0.3 acres of slumping along 500 feet of the anchorage boundary) will be impacted by dredging. Intertidal habitat is recognized as an important and limited resource with high ecological value. Mitigation is proposed for the unavoidable loss of intertidal habitat as a result of the proposed project (See Section VII. Mitigation and Incremental Analysis).

B. Disposal Site

1. General

The material dredged from the proposed project site will be placed on a scow and transported approximately 13 nautical miles southeast to the Foul Area Disposal Site (FADS). This disposal will require approximately 22 round trips from Smith Cove to the disposal buoy.

The site, located in Massachusetts Bay (see Figure EA-3) in 100 meters of water, is an Environmental Protection Agency (EPA) approved interim ocean disposal site with a circular boundary of two nautical miles diameter. The center of the site is at 42^{o}-25.7' north latitude and 70^{o}-34.0' west longitude, approximately 14.5 nautical miles southeast of Manchester Bay, Manchester, Massachusetts. This disposal site is locally called the Foul Area because of the many fishing net "hangs" that could foul the equipment.

During the past disposal activity at FADS, 62.1% of all material was silt and clay (greater than 4 phi) and 37.3% was sand (-1 to 4 phi) the remaining 0.6% was gravel (less than -1 phi). The Foul Area Disposal Site (FADS) provides a stable low energy environment for containing dredged material. Nearshore disposal could allow storm activity to resuspend dredged silt and clays and upland disposal sites are few and expensive on this urban coastline. In addition, the Dredged Material Management Section (DMMS) of the New England Division, U.S. Army Corps of Engineers, has the responsibility to manage and monitor the disposal of dredged material at this site. DMMS is currently conducting oceanographic studies of FADS that will be used to determine whether the interim site will be designated as a permanent EPA approved dredged material disposal site.

2. Physical and Chemical

Preliminary results of the DMMS oceanographic studies indicate the site is located in a low energy, deepwater environment, allowing containment of dredged material within the site. The disposal buoy is at a 100 meter deep portion of the site, where bottom currents are less than 35cm/sec (SAIC, 1985). Analysis of a hopper dredge disposal, which disposed a mixture of water and dredged material in a slurry, defined a disposal plume settling within a circle of a 350-meter radius.

The physical properties of the substrate near the disposal point is varying in composition, predominantly sandy silt, reflecting the various harbor dredging projects disposed here. The natural bottom covering the majority of FADS, e.g. areas of the site that have not received dredged material, is a fine silt/clay substrate (NED unpublished data). The composition of this natural material indicates the basin is a depositional area capable of containing the dredged material. If sufficient currents frequented this area of the basin, the fine grained material would be suspended and transported with the current. Areas of high current velocities are characterized by coarser grained (heavier than silt/clay) substrate, a substrate that is not typical of this basin.

A summary of the chemical composition of 25 stations from FADS is presented in the Disposal Area Monitoring System (DAMOS) 1984 Program Results Document (SAIC, 1985). In summary, the April 1983 chemical concentrations of the substrate at FADS can be categorized as Types IA and IIA. Percent volatile solids averaged 3.3% (S.D. 0.1) which is Type A. Oil and grease concentrations measured 1785.3ppm (S.D. 1102.8), classified at Type A. Chromium averaged 152.0 ppm (S.D. 75.1) and zinc averaged 235.8 ppm (S.D. 73.3), both Category II. Copper concentrations in FADS sediments were classified as Category I at 64.8 ppm (S.D. 32.7) Arsenic concentration averaged value was 9.8 ppm (S.D. 3.4) (the standard deviation exhibited a range into the Class II Category). Earlier cruises in January 1983 analyzed lead and mercury levels at FADS at nine stations (SAIC, 1985) and found Category I lead and mercury levels of 44.2 ppm (S.D. 18.0) and 0.11 ppm (S.D. 0.04), respectively. All other levels were comparable or less than the April 1983 values except percent volatile solids (4.3, S.D. 1.9). No PCB concentrations were reported; however indications from present studies define spatial variability in concentrations and ambient concentrations are currently being assessed.

3. Biological

Recent sampling of the benthos at the FADS (S.A.I.C., 1986) described three distinct community assemblages as occurring. These assemblages reflect the various sediment facies within the site. The northeast section of the site has an unimpacted coarse sand and gravel composition. The benthic community was sampled in the fall of 1985. This assembly was numerically dominated by the Syllidae polychaete *Exogone verugera profunda* (907/m2); the Paraonidae polychaete *Levinsenia gracilis* (350/m2); and the Spionidae polychaete *Prionospio steenstrupi* (313/m2). A total of 105 species averaging 4,433 organisms per square meter were recovered.

The western portion of the FADS has been impacted by continued disposal of dredged material from the greater Boston region. Approximately 5 million cubic yards per decade of material is disposed in this section of FADS. This continual disturbance of the bottom maintains the community of benthic organisms in a dynamic equilibrium. The most adaptable species proliferate. Those species that reproduce rapidly and have high numbers of offspring (i.e. larvae) colonize the newly disposed dredged material (r-strategists of classical ecology) and biogenically rework the substrate. Given time this pioneering community would alter the sediment character and allow a more mature community to develop. The frequent disposal activity maintains the resident population of the disposed material area as a pioneering sere. This assemblage at FADS was dominated (Fall 1986) by oligochaetes (6,293/m2); the Spionidae polychaete Spio pettibonae (4,607/m2); and the Cirratulidae polychaete Chaetozone setosa (2,160m2) and the Capitellidae polychaete Mediomastus ambiseta (1,757/m2). A total of 78 species averaging 25,467 organisms per square meter were recovered.

The southeastern section of FADS has an unimpacted silt-clay sediment facies. The lack of physical disturbance (burial) by disposal of dredged material has allowed a mature benthic assemblage to become established. Interspecific competition within a mature community results in the presence of considerably lower densities of individuals (e.g. 8,390/m2) than found in continually disturbed habitats (e.g. 25,467/m2). The undisturbed southeastern section of FADS was dominated by the Paraonidae polychaete Levinsenia gracilis (1583/m2); oligochaetes (1,050/m2); the Cirratulidae polychaete Chaetozone setosa (760/m2); and the Capitellidae polychaete Mediomastus ambiseta (693/m2). The Fall 1985 sampling in this section of FADS recovered a total of 57 species averaging 8,390 individuals per square meter.

Various finfish species have been collected during recent sampling cruises (S.A.I.C., 1986) within the Foul Area Disposal Site. In the spring of 1985 the spiny dogfish Squalus acanthias was the dominant finfish recovered. This species migrate seasonally in large schools. Those sampled at FADS were found to be feeding on flounder, sculpin and anemones. Fall 1985 finfish collections were dominated by the witch flounder or grey sole Glyptocephalus cynoglossus and the dab or american plaice Hippoglossoides platessoides. The former was found to be foraging on polychaetes (e.g. Chaetozone sp.; Spio sp.; Sternapsis sp. and Tharyx sp.). The latter was found to be foraging on brittle stars (Ophiuroidea).

C. <u>Threatened and Endangered Species</u>

The vicinity of the Foul Area serves as seasonal habitat for three species of whales: the humpback (<u>Megapteria novaengliae</u>), the fin whale (<u>Baleanoptera physalus</u>) and the northern right whale (<u>Eubalaena glacialis</u>) (NMFS, letter dated June 23, 1986). All three are federally listed as endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 <u>et seq</u>.).

Humpbacks are generally found in the south-western Gulf of Maine (Stellwagon Bank and Jeffrey's Ledge) from May through October with highest concentrations occurring during the summer and early fall (Weinrich <u>et</u>. <u>al</u>., 1986). Lower concentrations occur during the winter and early spring. The largest percentage of the Gulf of Maine stock migrate south to the Caribbean during the fall and north to the Gulf of Maine during spring. Fin whales are more commonly found all year around but have their highest concentrations during the spring, summer and early fall. Most individuals move south or offshore during the cooler winter months; however, some overwintering occurs in the Gulf.

The distribution of both species within the Gulf has been related to movements of prey species: historically, schooling Atlantic herring (<u>Clupea harengus</u>) a krill (<u>Euphausiidae</u>) and more recently American sandlance (<u>Ammodytes americanus</u>) (Overholtz and Nicolas, 1979, Meyer <u>et</u>. <u>al</u>., 1979). Populations of both whale species in the Stellwagon Bank and Basin area were markedly reduced in 1986 which may be related to the low population of American sandlance (NMFS personal communication). However, based on sitings from three years and surveys conducted by the University of Rhode Island in 1979-1981, Kenney (1985) indicated that the 10 minute square in which the Foul Area is located (center point 42° 25'N, 70° 35' W) is among the second highest "high-use habitat areas" for humpbacks and finbacks during the spring through fall months.

The northern right whale, the most severely endangered whale in the Northwest Atlantic, also uses the Stellwagon Bank/Basin Area. Because of their population, winter weather conditions and their practice of sub-surface feeding, observations of this species in the Gulf of Maine have been limited. Documentation of this occurrence at the Foul Area have been made only recently. In 1985, two independent investigations identified discrete groups of right whales during March and April (Weinrich <u>et</u>. <u>al</u>. 1986; Mayo <u>et</u>. <u>al</u>., 1986). Weinrich <u>et</u>. <u>al</u>. (1986) also noted a second peak of sitings during July 1985 in the Stellwagon area. Long term sitings in the Cape Cod Bay area south of the Foul Area, indicated April-May peaks although observations have been made as early at January and February and as late as October (Watkins and Schevill 1982; Mayo <u>et</u>. <u>al</u>. 1986). The Cape Cod Bay/Stellwagon Bank-Basin areas may serve as short-term residence areas between the southern wintering grounds (Georgia-Florida) and the northern summer grounds in the lower Bay of Fundy (Mayo <u>et</u>. <u>al</u>. 1986). More studies in these areas are needed to confirm this. However, Mayo <u>et</u>. <u>al</u>. (1986) believes that the Stellwagen Basin area in which the disposal site is located may provide significant feeding areas for the right whale during periods of productive plankton blooms (primarily during late winter and spring). A small number of whales also winter in the Gulf of Maine waters but little information is known of their movements.

Movement and behavior in the vicinity of the Foul Area have been related to feeding on discrete zooplankton patches made up of copepods and barnacle larvae (Weinrich et al. 1986, Mayo et al. 1986). Courtship and nursing behavior have also been observed in the Cape Cod Bay, south of the Stellwagon Basin (Mayo et al. 1985).

D. Historical and Archaeological Resources

A letter dated 9 September 1986 to the Massachusetts Historical Commission requesting comments concerning the presence of historic or prehistoric resources in the project area yielded a determination that no significant cultural, historical or archaeological resources exist in the proposed area.

E. Social and Economic Resources

Gloucester Harbor is one of New England's major fishing ports with an existing Federal navigation project which provides several access channels and anchorage areas. Current trends in the commercial fishing industry require larger vessels to accommodate greater distance traveled to the finfish grounds and larger per trip catch. Presently, there is limited deep-draft anchorage areas in Gloucester Inner Harbor. Several shallow draft vessels presently moor in deep draft areas along Gloucester Fish Pier. With future fleet modernization and increase number of deep draft vessel, nine boats would be displaced from the harbor. Smith Cove would provide additional shallow draft anchorage to accommodate displaced vessels.

VI. ENVIRONMENTAL CONSEQUENCES

A. Dredge Site

1. General

The proposed project will remove 33,000 cubic yards of predominantly silt/clay material from Smith Cove. Dredged material will be removed over a 5 week period with a clamshell dredge, loaded into scows and towed 13 miles southeast to the Foul Area Disposal Site (FADS). Removal of ledge rock from portions of the anchorage area may require drilling and blasting with dynamite. The lethality of explosive activities on fish is directly related to its detonation velocity, charge weight, density of the material to be blasted, and the size, location and orientation of the fish. Explosives in a rock or clay substrate produce low-level overpressures with subsequent reduced lateral or vertical pressure changes. The limited amount (1000 cubic yards) of rock to be blasted and the season of activity would minimize the impacts to the fish populations if blasting did occur. The type of blasting that may be conducted is of the "fracture type" as opposed to the "removal" or open water blasting operations. A modification of Yelverton's blasting model (Yelverton, et al. 1975) indicates that a maximum 50% mortality rate for fish could occur within 30 meters of the blasting.

The technique for excavation of a submerged ledge is similar to that used in routine highway construction. Bore holes are drilled into the rock where explosives are then placed. This type of blasting technique has limited horizontal amplification. In fact, the overlying waters act as a buffer or blanket which prohibits or reduces any horizontal impacts resulting in a vertical crumbling or collapse of the rock formation. Blasting at high tide will further reduce any horizontal amplification. Increases in any turbidity and/or suspended sediments would have a minor and temporary effect.

To minimize interference with recreational activities and movement of boats, the work will take place during mid October to the end of March. Approximately 22 trips with a 1,500 cubic yard scow will be required to complete the project. Short term impacts include a suspension of silt and clay in the water column during dredging and disposal operations and a destruction of the benthic community because of its removal through the dredging process. Long term impacts are expected to be minimal due to tidal flushing and settling of suspended materials and recolonization of benthic organisms.

2. Physical and Chemical Effects

Smith Cove will be dredged using a clamshell or bucket dredge. With this type of dredging, the majority of material is excavated in a cohesive mass, however, a portion of the sediments will become temporarily suspended in the water column. The suspended material (primarily the silt/clay fraction) is derived from overflow and leakage of the dredge bucket and the disturbed substrate. In addition, the underlying exposed sediments will be temporarily unstable and oxygen depleted at the sediment/water interface. Subsequent physical and biological activity will stabilize and oxygenate the substrate.

Bohlen (1979) analyzed the effects of dredging a silt/clay substrate in New London Harbor, Connecticut. This research concluded the effects of suspended silt on water quality to be of short duration and localized to the immediate dredge site. Suspended silt increases water turbidity levels, reduces vision and masks odors important to foraging organisms. Suspended silt may also clog or abrade gill structures and interfere with the feeding mechanisms of filter feeders. Reduced light penetration as a result of turbidity lessens primary productivity and therefore oxygen released from the photosynthetic process. In addition, the usually high organic content of silt/clay material may also depress ambient oxygen concentrations. Finally, upon settling, the suspended sediment load, both sand and silt/clay could cover non-motile organisms. All of these effects are expected to be spatially and temporally limited.

During various dredging operations, scientific analysis of the spatial and temporal persistence of the turbidity/organic plume has been quantified. In the summer of 1977, the extent and duration of the impacts from dredging the Thames River/New London Harbor channels were studied (Bohlen et.al., 1979). Dredged material was predominantly silt/clay (>4 phi). The conclusions of this study defined the plume of suspended materials from the dredging operation as having a maximum extent of 700 meters downstream. Analysis of the composition and concentration of the plume indicated the majority of material suspended occurred within 30 m of the dredge. Suspended material concentration ranged from 200 mg/l to 400 mg/l resulting from suspension of approximately 1.5 to 3.0% of the substrate in each bucket load. Suspended material concentrations were reduced by a factor of ten within the first 200 meters downstream of the dredge. Mid-water and near bottom concentrations returned to background levels 700 meters downstream of the dredge. Similar values could be expected through storm perturbations several times throughout the year in Smith Cove.

All of the effects associated with increased turbidity would occur in the immediate area of the dredge, be transported by currents and settle. After completion of dredging activity, these impacts will cease. The motile organisms will escape these impacts by leaving or avoiding the activity area. The remaining organisms are estuarine species that are tolerant of many stresses and will be able to tolerate the associated turbidity impact.

One of the functional characteristics of an estuarine system, such as Smith Cove, is to serve as a nutrient retention area, increasing the productivity of its subcomponents. Nutrients are effectively "trapped" in the sediments and stored. This trapping and storage function also allows for the retention of pollutants in the same substrates, especially in fine grained sediment which have a larger volume of surface area for pollutant adsorption. The physical removal of these sediments by dredging operations has the potential to release some of the sediment bound pollutants.

One group of contaminants that have been of concern for environmental quality analyses are metals such as mercury (Hg), cadmium (Cd), chromium (Cr), lead (Pb), copper (Cu), arsenic (As) and zinc (Zn). Recent studies have shown that even when metals are found in high concentrations, there does not exist a corresponding substantial release of free (non-bound) metals from resuspension of bottom sediments during dredging. Studies performed by the Corps of Engineers Dredged Material Research Program concluded that certain trace metals may be released in the parts per billion (ppb) range, while others show no release pattern (Chen, 1976). Chen (1976) also showed that heavy metals are not readily soluble or excessively mobile through a system since they are usually adsorbed to sediments or coprecipitated out of solution.

Other classes of constituents that are of concern are PCB's (Polychlorinated Biphenyls), PHC's (Petroleum Hydrocarbons) and DDT (Dichloro Diphenyl-Trichloethane: a chlorinated pesticide). The presence of these chemicals in Smith Cove were analyzed by elutriate and bulk chemical testing. Fulk et. al. (1975) demonstrated the release of pesticides from bottom sediments into the water column during dredging is not significant. Petroleum Hydrocarbons (PHC's) are a by-product of industrialization of estuarine areas and are detrimental to the ecosystem only when released in very high concentrations. The concentrations of PHC's in the Smith Cove substrate are moderate, given an average oil and grease concentration of 1872.6 ppm (S.D. 2204.26).

Potential for release of sediment contaminants during the dredging and disposal processes can be effectively evaluated by using the standard elutriate test. These tests are defined in the Environmental Protection Agency and the Corps of Engineers document: "Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters" (1977). This analysis mixes one part sediment with four parts dredge site water creating a 20% solids slurry. This mixture is then allowed to settle for 0.5 hours and the supernate is decanted and filtered. Analysis of the supernate overestimates the sediment interaction that occurs during mechanical dredging, since a majority of the substrate is removed in a cohesive mass within the bucket. The use of this data represents a "worst case" scenario for potential impacts to the water column during dredging. Upon cessation of dredging activities, the cove will be completely flushed within 1.4 tidal cycles (Sanford Ecological Services, 1985).

Elutriate analysis was conducted by NED in 1985 on two Smith Cove sampling stations Station A and Station E (Appendix VI). As was discussed previously, elutriate samples from the NED 1983 sampling in Smith Cove were not within the dredge site boundary (see Appendix V). Therefore, the 1985 stations will be discussed as the more accurate representative of possible elutration during dredging activity (see Figure EA-2 for sample locations). Comparison of dredge site water with elutriate supernate reveals no potential releases of nitrate/nitrite, nitrogen, sulfate, mercury, lead, zinc, cadmium and DDT exist.

The potential exists for oil and grease to be released in concentrations of 1.02ppm (S.D 0.53) at Station A and 1.24 ppm (S.D. 0.56) at Station E compared to a recorded ambient level of <0.3 ppm. Phosphorus at Station A eluded concentrations of 0.19 ppm (S.D. 0.08) orthophosphate and 0.28 ppm (S.D. 0.096) total phosphate above the ambient 0.02 ppm (ortho) and 0.06 (total) concentrations. Station E only exhibited the potential for elutriation of total phosphorus above the 0.06 ambient concentrations at 0.08 ppm (S.D. 0.01). Vanadium only exhibited elution potential above the 0.7 ppb ambient concentration at Station A to 18.3 ppb (S.D. 7.51).

Oil and grease determinations represent a measure of the cumulative concentration of substances that are soluable in trichloro trifluorethane, the operative solvent. It includes determinations of biological lipids, mineral hydrocarbons, sulfur compounds, certain organic dyes and chlorophyll (APHA, 1980). There are no EPA water quality standards applicable to this analyses, but the potential for dissolved or emulsified oil and grease to be released from the substrate exists. This potential is not assumed to be greater than storm induced agitations in this shallow cove. The removal of the substrate in a cohesive mass and subsequent tidal flushing will minimize these elutriations as well as phosphorous and vanadium releases.

Chromium showed a potential for elutration during dredging, the highest replicate value being 7.4 ppb at Site "E". This value is significantly lower than the 1985 EPA water quality criteria (see Table EA-2) of 1,100 ppb for chromium. Nickel elutrated 20 ppb in one replicate at Site "E". However, this value is significantly lower than the 1980 EPA any time criteria for nickel of 140 ppb. The elutrated values for chromium and nickel are not expected to pose significant environmental consequences.

Phosphorous represents materials from biological processes, agricultural fertilizers and detergents, occurring in both precipitated organic forms and incorporated into organic compounds. As discussed, the addition of this nutrient into the Smith Cove ecosystem will have minimal impact. Phosphorus also does not have an applicable marine water quality standard.

Vanadium is a metal that in trace amounts has been found to be beneficial to the human metabolism. The mean concentration of vanadium in U.S. drinking water is 6ppb (APHA, 1980). Industrial applications include dyeing, ceramic, ink and catalyst manufacture. The presence of vanadium in the ambient Smith Cove water column at a 7ppb concentration is assumed negligible given its 6ppb level in drinking water. Elutriation of this metal only occurred at Station A above ambient at an average concentration of 18.3 ppb. Vanadium also does not have an applicable EPA Water Quality Criteria.

TABLE EA-2

EPA Water Quality Criteria (Saltwater)

Contaminant	Anytime	Criteria 1 hr avg.	4 day avg.
Mercury (Hg), ppb	-	2.1*	0.025*
Lead (Pb), ppb	-	140*	5.6*
Zinc (Zn), ppb	170**	58**	
Arsenic (As), ppb	-	69*	36*
Cadmium (Cd), ppb	-	43*	9.3*
Chromium (Cr), ppb	-	1,100*+	50*+
Copper (Cu), ppb	-	2.9*	-
Nickel (Ni), ppb	140**	7.1**	-
Vanadium (V), ppb	-	-	-
Total PCB, ppb	-	0.03**	-
Total DDT, ppb	0.13**	0.001**	-

* 1985 Criteria Federal Register Vol. 50. No. 145 July 29 1985
** 1980 Criteria Federal Register Vol. 45. No. 231 November 28 1980
\+ Chromium (Vl) Criteria

Note: The appropriate EPA publications should be referred to for a full explanation of the above criteria.

Chemical constituents with the potential to elutriate above EPA water quality criteria were copper and PCB's. Average value for copper over three replicates at Site "A" was 30.6 ppb (S.D. 15.95) which exceed the EPA 1985 water quality criteria of 2.9 ppb. Ambient conditions in dredge site water (27.5 ppb) also exceed EPA criteria. Copper did not elutriate over ambient conditions in any replicate at site "E".

PCB's also showed a potential for elutration during dredging in Smith Cove. Sites "A" and "E" had averaged values of three replicates of 0.087 ppb (S.D. 0.023) and 0.33 ppb (S.D. 0.32), respectively. Ambient conditions for PCB's in dredge site water (0.05 ppb) also exceed the EPA water quality standard.

In order to predict the impact on the chemical composition of the water column by dredging sediment with elutriatable components (e.g. Copper and Polychlorinated Biphenyls), a dilution calculation was performed (see Appendix VIII). This was an instantaneous rate calculation using the mean low water column and depths to approximate the worst case scenario. It is a comparison of the potential impacts from sediment-water interactions (elutriations) during dredging with the ambient Smith Cove water column.

The elutriated value of copper averaged 30.6 ppb (S.D. 15.95) at Station A and 16.5 ppb (S.D. 7.25) at Station C. The highest single replicate at this station was 44.0 ppb (0.044 ppm). The dilution calculation determined the dilution factor (d) for Copper as 32. The ambient concentration of Copper in Smith Cove is 27.5 ppb. The volume of water required to dilute this Copper replicate value to approximately the ambient (28.0 ppb or 0.028 ppm) concentration is 1,305.6 m^3. Therefore, 1.6% of the Smith Cove water column will be impacted using an average mean low water column depth of 1.71 meters. This describes an impact radius of 20.4 meters surrounding the dredge as a worst case. Given tidal flushing, this impact is not considered significant.

The elutriated value of PCB averaged 0.087 ppb (S.D. 0.0230) at Station A and 0.33 ppb (S.D. 0.32) at Station B. The highest single replicate at this station was 0.70 ppb (0.0007 ppm). The dilution calculated determined the dilution factor (d) for this concentration of PCB as 129. The ambient concentration of PCB in Smith Cove is 0.05 ppb. The volume of water required to dilute this PCB replicate value to approximately the ambient (0.051 ppb or 0.00051 ppm) concentration is 5,263.2 m^3. Therefore, 6.4% of the Smith Cove water column will be impacted using an average mean low water column depth of 1.71 meters. This describes an impact radius of 40.9 meters surrounding the dredge.

3. Biological Effects

The dredging of 33,000 cubic yards of substrate from the Smith Cove destroys benthic habitat and associated organisms by physical removal. Recent investigations (Van Dolah et. al., 1984) in other estuarine systems have shown these effects are short-lived (3 months). Pioneering organisms will dominate the disturbed habitat through faunal recolonization and biogenically work the substrate. After a few seasons, serial succession will occur and increasing numbers of species will inhabit the area until the predredging benthic community structure will be obtained. Larval recruitment of benthic organisms (larvae successfully settling on and inhabiting the substrate) will occur from adjacent population of similar organisms. The oligochaeta Peloscolex benedeni and the polychaetes Capitella capitata and Streblospio benedicti can be expected to rapidly recolonize the dredging site. Recent scientific investigations (Pearson and Rosenberg, 1978) have identified these species as having the ability to inhabit a variety of substrates that would normally prove stressful to other species.

Photosynthetic processes and associated productivity will be decreased during high periods of turbidity. This reduction in primary production will be temporary. Sediment suspension will also displace motile species avoiding gill abrasion, lower oxygen levels and reduced sensory opportunities for predation (masked odors and low visibility) in the dredging area. These would all be temporary and insignificant effects. To avoid these turbidity affects on shellfish (Mya arenaria) spawning and larvae in Smith Cove, the project should not occur in the spawning season, i.e. approximately July through September (NMFS, 1980). This improvement dredging and future maintenance dredging will be scheduled to avoid impacting this resource and minimize interference with recreational activities and movement of boats (i.e. mid October to the end of March).

B. Disposal Site

1. General

The material dredged from Smith Cove will be placed on scows and transported to the Foul Area Disposal Site. The disposal will occur by bringing the scow to a complete stop at a predescribed point marked by a buoy positioned by NED. The discharge will occur in approximately 100 meters of water.

This site has been studied by NED. Precision bathymetry, sediment grab sampling, and the REMOTES image analysis (sediment profiling) have characterized this site as a low energy environment suitable for dredged material disposal and containment. Additional oceanographic sampling is currently being conducted in reviewing the interim ocean disposal site status of this site.

2. Physical and Chemical Effects

A turbidity plume will be created by the disposal of the dredged material. The release of contaminants from these sediments should be no greater than those concentrations determined by the elutriate testing. The levels will be considerably less for the turbidity plume, since most of the material will remain consolidated. This impact on the water column at the disposal site will be short lived.

The results of the 1985 elutriate test for Smith Cove are listed in Appendix VI. These tests compare the elution potential of dredge material to dredging site water, not Foul Area Disposal Site Water. Comparison of dredge site water with elutriate supernate reveals no potential release of nitrate/nitrite, nitrogen, sulfate, mercury, lead, zinc, cadmium and DDT exists.

The potential exists for oil and grease to be released in concentrations of 1.02 ppm (S.D 0.53) at Station A and 1.24 ppm (S.D. 0.56) at Station E into a recorded ambient level of <0.3 ppm. Phosphorus at Station A eluded concentrations of 0.19 ppm (S.D. 0.08) ortho-phosphate and 0.28 ppm (S.D. 0.096) total phosphate above the ambient 0.02ppm (ortho) and 0.06 (total) concentrations. Station E only exhibited the potential for elutriation of total phosphorus above the 0.06 ambient concentrations at 0.08 ppm (S.D. 0.01). Vanadium only exhibited elution potential above the less than ppb ambient concentration at Station A to 18.3 ppb (S.D. 7.51).

Chromium showed a potential for elutration during dredging however, the highest single replicate value (7.4 ppb) was significantly lower than the 1985 EPA water quality criteria (see Table EA-2) of 1,100 ppb for chromium. Nickel elutrated 20 ppb in one replicate at Site "E" however, this value is significantly lower than the 1980 EPA any time criteria for nickel of 140 ppb. The elutrated values for chromium and nickel are not expected to pose significant environmental consequences during disposal operations.

Chemical constituents with the potential to elutriate above EPA water quality criteria were copper and PCB's. Average value for copper over three replicates at Site "A" was 30.6 ppb (S.D. 15.92) which exceed EPA 1985 water quality criteria 2.9 ppb. Ambient conditions (27.5 ppb) also exceed EPA Standards. Copper did not elutriate over ambient conditions in any replicate at Site "E".

PCB'S also showed a potential for elutration during dredging in Smith Cove Sites "A" and "E" had averaged values of three replicates of 0.09 ppb (S.D. 0.02) and 0.33 ppb (S.D. 0.32) respectively. Ambient conditions for PCB's (0.05 ppb) exceed EPA water quality standards.

Dilution calculations were performed (see Appendix VIII) for copper and PCB's to evaluate the potential impacts from sediment-water interactions (elutriations) during dredging. These results are discussed in Section VI.A.2. (Environmental Consequences Section) of this document. Copper and PCB's diluted to ambient condition within 20.4 meters of the dredge and 40.9 meters of the dredge respectively. The volume of water (100 meter depth) available at the FADS is considerably more than in Smith Cove which leads to the conclusion that the radius of impact during disposal operations would be significantly less than calculated for dredging.

Recent studies (SAIC, 1985) concluded the concentrations of suspended materials in the turbidity plume, following disposal, will be no greater than 5 to 12 mg/l, forty minutes after disposal. These studies were conducted at the Foul Area Disposal Site with hydraulically dredged hopper material disposed in 100 meters of water. This method of dredging mixes the sediment with water to form a slurry representing the maximum possible suspension of material. The bucket dredging technique to be used for this project will maintain the disposed sediments in a cohesive mass, greatly reducing turbidity potentials.

Physical parameters such as currents, waves, and tidal circulations have been closely monitored at the site (SAIC, 1985). This area has contained dredged material on site and does not disperse sediment or chemicals to affect ambient environments.

3. Biological Effects

The disposal of dredged sediments will bury those non-motile and larval/juvenile organisms at the Foul Area Disposal Site that have inhabited the previously disposed material. The same pioneering species will quickly inhabit the newly disposed material by larval and adult recruitment. The overall process of maintaining a disturbed habitat will provide a productive benthic environment for organisms that will rework the substrate. This biological mixing of the substrates (bioturbation) will homogenize and oxygenate the upper few centimeters of the sediment. This will allow other organisms to begin inhabiting the substrate (colonization). Larva will settle and metamorphize and adults will emigrate into the area all contributing to restore benthic/productivity.

To determine if the Smith Cove material will have a detrimental impact on the biota of the disposal site due to chemical constituents of the sediment, bioassay and bioaccumulation studies were performed using substrate from Stations A and E. The results of this testing is presented in Appendix VI of this report. All analysis procedures were in accordance with the guidelines established by the Environmental Protection Agency and the U.S. Army Corps of Engineers (1977).

The bioassay and bioaccumulation tests provide an indication of the chemical effects of the substrate on organisms that come in contact with it. The bioassay procedure exposes healthy indicator organisms to an actual sample of the substrate and monitors the mortality of the organisms. The survival rates are calculated for the dredge material and a suitable reference site. The statistical analysis of the results provide an indication of the sediment toxicity to the biota. The bioaccumulation tests define the amount of chemicals that have been bioconcentrated in the body tissue of the organism from contact with the substrate along with chemicals ingested through feeding activities. These accumulations are reflected in the body tissue concentrations of the surviving test organisms. The organisms analyzed were the grass shrimp, Palaemonetes pugio, the hard clam, Mercenaria mercenaria, and the sandworm, Nereis virens.

Data produced by solid phase bioassays with grass shrimp, hard clams, and sandworms are presented in Appendix VII. Mean survival of organisms exposed for 10 days to dredged material was 98.0 percent (grass shrimp), 100.0 percent (hard clams), and 94.0 percent (sandworms). Mean survival of control organisms was greater than 90 percent, thus allowing evaluation of data from tests with reference sediment and dredged material. These data indicate that total survival of organisms exposed to the solid phase of dredged material was not significantly lower than total survival of organisms exposed to reference sediment. Thus, it is concluded that, with regard to its toxicological effects, the solid phase of the dredged material is ecologically acceptable for discharge to the proposed disposal site[1].

The bioaccumulation studies involved tissue analysis of organisms surviving the 10-day solid phase for contaminants of concern such as Hg, Cd, DDT, PCBs and Aliphatic/Aromatic Petroleum Hydrocarbons. Mean concentrations in the test sediment of Hg, PCB's and Aromatic Petroleum Hydrocarbons in Mercenaria mercenaria and PCB's and Aromatic/Aliphatic Petroleum Hydrocarbons in Nereis virens were all below values in corresponding organisms exposed to the reference sediment. The remaining tissue samples from those animals exposed to the test sediment, even though higher than reference values, were not statistically significant in comparison to the tissue from organisms in the reference sediment. However, statistical significance did occur for PCBs in Palaemonetes pugio with a mean test value of 0.09 ppm. The action level for PCB's in edible marine organisms, set by the FDA is 2 ppm. This action level is approximately 22 times greater than the value obtained in the shrimp. Therefore, it is felt that the PCB test level is quantitatively insignificant. It is NED's preliminary determination that the bioassay/bioaccumulation test results show the material to be dredged from Smith Cove to be ecologically acceptable for disposal at the Foul Area.

C. Threatened and Endangered Species

The Foul Area Disposal Site is inhabited by the endangered humpback (Megaptera novaeangliae) and fin whales (Balaenoptera physalus) from May to October and the endangered right whale (Balaena glacialis) inhabits the area from March through May. The proposed project is scheduled for mid October to the end of March to avoid the recreational season and interference with the movement of boats. As a consequence, this time frame reduces the possibility of encounter with a whale at the Foul Area. If any transient endangered species entered the area during the disposal operation, they would avoid the

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1 Paragraph 37, page F17, Appendix F of the EPA and COE manual for dredged material (U.S. EPA and U.S. Army COE, 1977) states that a solid phase has "real potential for causing environmentally unacceptable impacts on benthic organisms (only if) the difference in mean survival between animals in the control and test sediments is statistically significant and greater than 10 percent".

disposal activity. Since all impacts on the environment are temporarily and spatially limited, impacts on the food sources of these species are also assumed minimal.

D. Historical and Archaeological Resources

The proposed project will have no effect on significant cultural, historical or archaeological resources. The Massachusetts Historical Commission concurred with this finding in a letter dated 25 September, 1986.

E. Social and Economic Resources

Construction related effects generally are short term and site specific. Ten to 30 people would be temporarily employed as a direct result of project implementation.

Dredging would be performed by a bucket dredge. A dredging barge, two scows, and a tug would be utilized to allow for a continuous dredging operation. The presence of dredging equipment would hinder normal traffic flow within the harbor area. This increase in harbor vessels would temporarily increase the safety hazards and accident risks faced by boaters. Dredging between mid October to the end of March as proposed would minimize these effects.

Implementation of the Corps' project would increase the operating efficiency of the Gloucester fleet. The overall impact on the city and region would not be significant.

VII. MITIGATION AND INCREMENTAL ANALYSIS

Mitigation is proposed for the loss of approximately two acres of intertidal habitat associated with the project. Development along the northeast coast involving dredging and filing has resulted in the incremental loss of intertidal habitat in Massachusetts. This has created a politically sensitive atmosphere and strict interpretation of wetland protection regulations among State and Federal agencies. The importance of the intertidal habitat at Smith cove is stressed in the interagency coordination letters from the U.S. Fish and Wildlife Service (22 March 1985 and 28 August 1989), the U.S. Environmental Protection Agency (27 November 1989), the Massachusetts Coastal Zone Management (25 September 1989) and the National Marine Fisheries Service (22 December 1989).

Mitigation plans for Smith Cove were developed following Corps Policy Guidance for Fish and Wildlife mitigation planning (ER-1105-2-50). Mitigation includes avoiding, minimizing, or compensating for adverse impacts as defined in Corps Planning Mitigation Policy (ER 1105-2-50). Recent guidance between EPA and the Corps requires a sequential approach to mitigation (Memorandum of Agreement (MOA) dated 15 November 1989). This sequenced approach was used in developing mitigation options for the loss of intertidal habitat at Smith Cove.

Avoidance. The need for an anchorage at Smith Cove has been stated previously in this assessment. There are no areas within Smith Cove where an anchorage could be placed without the loss of some intertidal habitat. A relocation of the anchorage in Smith Cove is not feasible due to the presently saturated mooring capacity in the harbor.

Minimization. Further reduction in the size of the anchorage will not meet the objectives of the project. Early in the planning process, the anchorage was aligned close to the rock riprap parking area in the southwestern portion of the cove to maximize mooring capabilities. The anchorage has since been redesigned to minimize impacts to intertidal areas.

Compensatory Mitigation. Investigations were undertaken to determine the feasibility of habitat creation from upland area or from filling of subtidal areas. Three criteria were used to screen potential upland sites in the Gloucester area a) the presence of ledge material which could result in unacceptable cost b) existing use of the land and c) the environmental value of the upland area.

The creation of intertidal from existing subtidal habitat is another possibility for replacement. The criteria to be used in selecting potential sites are a) hydrographic features of the area (depth and current regime) b) the resource value of the shallow subtidal area.

Habitat enhancement is viewed as a means of compensating for the loss of habitat value. Enhancement measures should be aimed at in-kind replacement of fish and wildlife resources. This enhancement of intertidal areas for shellfish is a potential mitigation measure that is supported by regional planning goals. Marsh restoration was suggested by Fish and Wildlife Service as a potential out-of-kind mitigation measure.

An incremental cost analysis for the project has been prepared in accordance with the Corps Planning Policy (ER 1105-2-185) to determine the least expensive and most efficient mitigation plan. Incremental analysis requires a) an inventory of fish and wildlife resources, b) a determination of significant net losses, c) a definition of mitigation objectives d) identification and assessment of potential mitigation strategies, e) a definition and estimation of mitigation plan increments and f) evaluation of incremental costs.

a. Inventory and Categorize Fish and Wildlife Resources.

Definition of impacted resources. Fish and wildlife resources may have both economic and environmental value. National Economic Development (NED) resources are those fish and wildlife resources having substantial commercial and/or recreational value. Environmental Quality (EQ) resources are those fish and wildlife resources having substantial non-monetary value from an ecological or aesthetic standpoint. The significance of fish and wildlife resources is based both upon their monetary (NED) and non-monetary (EQ) values.

Intertidal habitat is recognized nationally as an important and limited resource with high ecological value. The Corps 404 (b) 1 guidelines characterize intertidal flats as Special Aquatic Sites. Massachusetts Wetlands Regulations explicitly protect intertidal areas. Intertidal habitat is a high value EQ resource requiring mitigation for unavoidable losses.

The intertidal area that would be impacted is not a significant shellfish concentration area. Smith Cove is closed to commercial or recreational harvest due to existing water quality in the cove. The clam resources at Smith Cove are not recognized as a significant NED resource. They do contribute to the production on the flat and may contribute to the overall clam population in the area. Both of these factors contribute to the ecological value of the flat.

Inventory of resources. The intertidal habitat at Smith Cove is populated by a variety of benthic species. Mudflats are generally recognized as areas of high productivity. The benthic habitat is dominated by small opportunistic polychaetes species such as *Capitella capitata* and *Streblospio benedicti* and oligochaetes. Overall total benthic densities ranged from 13,275 to 22,500 per square meter. Average adult (greater than 2.0 cm) soft-shelled clam (*Mya arenaria*) densities in Smith Cove are 19.4 per square meter. Extrapolation of *Mya* densities suggests that there are 160,000 adult soft-shelled clams in the two acres of intertidal habitat proposed for dredging at Smith Cove.

These flats are important for a variety of fish and wildlife species. Waterfowl such as black duck and red-breasted mergansers, herring gulls, egrets and various shore birds use the intertidal flats for resting and feeding. Fish species such as Atlantic silversides, winter flounder, stickleback, mummichog, mackerel, smelt, and herring can be found feeding in the area.

Mitigation requirements. The Fish and wildlife Service has determined that the intertidal flats at Smith Cove are Resource Category 3 for mitigation purposes. Category 3 habitat designations are generally reserved for habitat types of high to medium value for evaluation species that are relatively abundant on a national basis.

The associated Fish and Wildlife planning goal is no net loss of habitat value while minimizing loss on in-kind habitat value. Out-of-kind replacement may be allowed if in-kind replacement is not possible. The aim of out-of-kind mitigation is to replace the habitat value of the intertidal flat with another habitat type of similar value (e.g. salt marsh or eelgrass beds). Written documentation and/or some sort of trade off analysis is required to justify equivalence of substituted habitat types and/or habitat values.

b. Determine Significant Net Losses.

Dredging would transform approximately two acres of intertidal to subtidal habitat. Although most of the species living in the intertidal zone are capable of colonizing the subtidal habitat, a review of the benthic data indicates fewer species and lower numbers of organisms occur in the subtidal areas. The intertidal fauna was represented by 26 species. Densities ranged from 13,275 to 22,500 per square meter. Three species *Capitella capitata*, *Streblospio benedicti* and *Oligochaeta* sp. accounted for 90% of the organisms. The subtidal fauna was represented by 18 species. Densities ranged from 138 to 7,706 per square meter. The subtidal samples were dominated by *Capitella capitata* which accounted for 36% to 99% of the organisms.

The shift from intertidal to subtidal habitat also decreases the utility of the area for waterfowl and migratory shorebirds. Increased boat activity in the area will also tend to discourage use of the habitat by fish and wildlife resources.

c. Define objectives.

The objectives of the mitigation plan is to replace the ecological value of the habitat lost. This includes value to migratory birds, waterfowl, demersal fish, and benthic organisms (including soft-shell clams). This can be achieved through in-kind replacement by the creation of intertidal habitat, through out-of-kind mitigation by the creation or restoration of habitat of similar fish and wildlife resource value such as salt marsh or through enhancement of an existing intertidal area. Off-site mitigation will be considered if a viable onsite mitigation is unavailable.

d. Identify and assess potential mitigation strategies.

1. Creation of intertidal habitat from upland area. The potential for intertidal habitat from upland areas was investigated. This would serve as in-kind mitigation with "no net loss" of intertidal habitat. Impacts to shellfish and other benthic organisms would be mitigated by passive recruitment into the new area. Shellfish populations could be enhanced by active seeding.

To date no areas have been identified that would be suitable for intertidal creation in the Smith Cove. The land around Gloucester Harbor is covered with glacial deposits through which many rock outcrops project (Sanford Ecological Services, 1985). The presence of rock around much of the perimeter of the cove limits the number of sites available. The bedrock of Gloucester Harbor is granite of the Cape Ann Intrusive Complex which underlies all of Cape Ann. This rock is particularly hard because of an unusually high quartz content (U.S. Army Corps of Engineers, 1984). The level of urban development in the project area further limits the availability of sites.

There is the potential for off-site mitigation in the Saugus River estuary located approximately 20 miles south of Gloucester Harbor. There is ample opportunity for intertidal restoration near the I-95 embankment. The Saugus River estuary supports a large marsh system. Intertidal habitat in this are would have high fish and wildlife value.

2. <u>Creation of intertidal by filling in subtidal areas</u>. This option would serve as in-kind mitigation resulting in "no net loss" of intertidal habitat. This plan has the added feature that it offsets the habitat change associated with dredging (i.e. intertidal to subtidal). Filling shallow subtidal would bury existing benthic organisms resulting in a temporary impact. Recolonization of the area by intertidal organisms would occur rapidly. Active seeding could be used to enhance the area for shellfish.

A suitable site for this mitigation plan has yet to be determined. The primary considerations in selecting a site would be the existing environmental value of the site, engineering feasibility in terms of cost and stability of the material.

3. <u>Marsh restoration</u>. This approach was suggested by U.S. Fish and Wildlife Service. This mitigation plan would be out-of-kind mitigation for the loss of habitat. This would be viewed as an acceptable trade-off given the high resource value of salt marsh habitat. A potential site for marsh restoration has been identified within the project area or vicinity. Removal of fill and marsh restoration at the Saugus River estuary could also be considered as off-site mitigation.

4. <u>Enhancement</u>. Enhancing unproductive clam flats for shellfish could be used to compensate for the loss of habitat. Instead of replacement, the goal is to increase the value of nearby flats. Shellfish enhancement programs are generally designed to benefit recreational and commercial shellfishermen. However, when properly managed they can provide benefits to shellfish populations and to fish and wildlife resources. Enhancement however, does not satisfy the "no net loss" requirements of the Fish and Wildlife Service planning goals for impacts to Category 3 wetlands and State regulatory permit guidelines.

Seeding. Seeding an intertidal flat is a method of enhancing an otherwise suitable habitat that is poor because of poor recruitment. The results of such enhancements are often temporal, however with proper shellfish management, shellfish seeding programs can be used to rejuvenate declining shellfish populations.

Net Enclosures. Nets may be placed on flats to enhance settling and survival of juvenile clams.

Substrate alteration. This method is used to enhance a habitat for shellfish. Three techniques can be used.

1. Resurfacing. This involves the placement of sand on unproductive clam habitat. This enhances the settlement of clam spat. Mitigation involves the placement of 3-12 inches of clean sand on an unproductive intertidal flat for the purpose of enhancing seed clam attachment. Two sites in the vicinity of the project area have been selected as potential candidates for resurfacing.

2. Hydraulic alteration employs a stream of water from a high pressure hose to aerate surface sediments. This approach, although experimental, is currently being tested on flats in the area.

3. Mechanical. This involves the physical reworking of sediments with large machinery to aerate the sediment.

e. Define and Estimate Costs of Mitigation Plan Increments.

1. Creation of intertidal from upland area. A generic cost estimate for the creation of intertidal from upland can be made using simple assumptions. The estimated amount of excavation required to grade one acre down from MHW to MLW is 7,300 cubic yards (cy). Given an estimated construction cost of $8/cy (which includes excavation and transport), the resulting cost would be $58,400/acre. The cost to purchase suitable upland property would be added to this construction cost.

2. Creation of intertidal by filling in subtidal areas. Construction costs for creating intertidal from subtidal depend largely on the amount of material required, the cost of the material, and the transportation of the material. The amount of material required depends on the depths of the area. In making a generic quantity estimate, a depth of -4.5 feet is used. This depth is seen as a compromise which minimizes the amount of fill while taking into account the barges depth requirements. Approximately 7,300 cy of material would be needed to grade one acre of subtidal (-4.5 feet) to intertidal (MLW).

The cost of the material depends on the source. Sand from pits in the area costs approximately $10/cy. The cost (including material) of transporting the material to the site and loading the material onto a barge would result in a unit cost of $20/cy. Therefore, the cost for this mitigation alternative is $146,000/acre.

Offshore sites could be used as a potential source for the material. This would eliminate purchase cost of the material and the need for double handling. This material could be obtained using a small dredging contract to mine the sand or by using the material from other dredging projects in the area. It is estimated that the cost for acquiring and placing the material is $10/cy.

3. Marsh restoration. A generic cost estimate for the removal of fill material from a degraded wetland can be made using assumption similar to alternative 1 creation of intertidal from upland. Approximately 3,650 cy of excavation would be required to grade one acre down from MHW to +2 feet (MLW). Given an estimated construction cost of $8/cy, which includes excavation and transport, and an additional $5,000/acre for planting, results in an estimated cost of $34,200/acre. Additional real estate costs may be incurred and have to be added to this cost estimate.

4. Enhancement.

Seeding. Seeding an area can be accomplished at a cost of $7,000/acre. This assumes the substrate is suitable for clam spat attachment.

Net Enclosures. The costs associated with this include the 1/4" mesh net and labor involved with placing the net. More detailed cost estimates will be developed in the next phase of study.

Resurfacing. This involves the placement 3-12 inches of sandy material on unproductive clamflats for the purpose of enhancing the substrate for seed clam attachment. Sand will be placed using barges and spread with either a drag or manual labor. It will require 1,650/cy of sand to cover one acre with 12 inches. The estimated cost for obtaining and placing the material is assumed to be $20/cy. Using this figure, resurfacing costs are estimated to be $33,000/acre.

Other enhancement measures (e.g. hydraulic, physical, netting) are assumed to be less expensive since the cost to purchase sand is eliminated. It is assumed that existing habitat can be enhanced at a cost of $16,500/acre using these techniques. This would include monitoring and study costs.

f. Incremental Costs of Construction

The following is a list of mitigation costs.

	Cost Per Acre	Total Mitigation Cost (2 Acres)
Replacement		
Intertidal from upland	$ 58,400	$116,800
Intertidal from subtidal	$146,000	$292,000
Marsh Restoration	$ 34,200	$ 68,400
Enhancement		
Seeding	$ 7,000	$ 14,000
Resurfacing	$ 33,000	$ 66,000
Other Methods	$ 16,500	$ 33,000

Physical and land use constraints prevent mitigation within Smith Cove so emphasis is placed on locating potential mitigation sites within the Gloucester/Annisquam River system and adjacent watersheds. Due to the high cost of intertidal habitat replacement and the concensus that enhancement does not achieve the "no net loss" objective, a mitigation plan involving marsh restoration is recommended.

Marsh restoration in the Gloucester/Annisquam River system is the most comprehensive of the mitigation alternatives. This type of mitigation satisfies the "no net loss" goal of Federal and State agencies however, the success of this mitigation plan depends on the finding of a suitable site. The Saugus River estuary could be used for marsh restoration if a viable onsite plan is not possible.

Should marsh restoration prove unfeasible, several enhancement sites have been identified. It should be noted that enhancement does not fully satisfy the mitigation objectives to replace the ecological value of habitat lost. Enhancement measures may increase food availability for waterfowl and migratory shorebirds at the mitigation site however, the ecological value of two acres of intertidal habitat can not be fully replaced. This type of mitigation concentrates on the NED value of the resource (soft-shelled clams) which primarily benefits the commercial shellfishing industry.

Due to the high cost of resurfacing (reflective of the purchase of sand), other non-structural enhancement techniques (such as net enclosures, hydraulic enhancement, and mechanical reworking) will be performed to enhance the clam habitat. The choice of a particular enhancement technique or combination of enhancement techniques and the site for enhancement will be coordinated with the local shellfish warden, the regional shellfish board, Mass. Division of Marine Fisheries, Mass. Office of Coastal Zone Management and the Corps of Engineers during the next phase of the study.

VIII. COORDINATION

A public notice will be issued before dredging and construction. The proposed project was coordinated with the following Federal and State agencies:

Federal Agencies

Environmental Protection Agency - Boston, Massachusetts
National Marine Fisheries Service - Gloucester, Massachusetts
U.S. Fish and Wildlife Service - Concord, New Hampshire

Commonwealth of Massachusetts

Department of Environmental Management - Salem, Massachusetts
Department of Environmental Quality Engineering - Boston, Massachusetts
Office of Coastal Zone Management - Boston, Massachusetts
State Historic Preservation Officer - Boston, Massachusetts

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X. COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

Federal Statutes

1. Preservation of Historic and Archaeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: Not Applicable; project does not require mitigation of historic or archaeological resources at this time.

2. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: Public Notice of the availability of this report to the Regional Administrator of the Environmental Protection Agency for review pursuant to Sections 176c and 309 of the Clean Air Act signifies compliance.

3. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Compliance: Not Applicable; project does not involve the discharge of dredged or fill material into a water of the U.S.

4. Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1431 et seq.

Compliance: A CZM consistency determination shall be provided to the State for review and concurrence that the proposed project is consistent with the approved State CZM program.

5. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the U.S. Fish Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) has yielded no formal consultation requirements pursuant to Section 7 of the Endangered Species Act (correspondence dated 23 June 1986 and 2 July 1986).

6. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: Not Applicable; this report is not being submitted to Congress.

7. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Not applicable.

8. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the Fish and Wildlife Service, National Marine Fisheries Service and Massachusetts Department of Environmental Management signifies compliance with the Fish and Wildlife Coordination Act (correspondence dated 22 March 1985, 21 August 1985, 10 July 1986 and 28 August 1989).

9. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C.4601-4 _et seq_.

Compliance: Not applicable

10. Marine Protection, Research, and Sanctuaries Act of 1972, as amended,33 U.S.C. 1401 _et seq_.

Compliance: Circulation of this report for public review, including an evaluation and findings concerning the transportation or disposal of dredged material in ocean waters pursuant to Sections 102 and 103 signifies compliance with this Act.

11. National Historic Preservation Act of 1966, as amended, 16 U.S.C.470 _et seq_.

Compliance: Coordination with the State Historic Preservation Office determined that no historic or archaeological resources would be affected by the proposed project (correspondence dated 25 September 1986).

12. National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 _et seq_.

Compliance: Preparation of this report signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact is issued.

13. Rivers and Harbors Appropriation Act of 1899, as amended, 33 U.S.C. 401 _et seq_.

Compliance: No requirements for Corps projects or programs authorized by Congress. The proposed navigation improvement project is pursuant to the Congressionally-approved continuing authority program; i.e. Section 107 of the River and Harbor Act of 1962.

14. Watershed Protection and Flood Prevention Act, as amended, 16 U.S.C. 1001 _et seq_.

Compliance: No requirements for Corps' activities.

15. Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271 _et seq_.

Compliance: Not Applicable; project is located within the marine environment.

Executive Orders

1. Executive Order 11988, Floodplain Management, 24 May 1977 as amended by Executive Order 12148, 20 July 1979.

Compliance: Not Applicable; project is not located within a floodplain.

2. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Circulation of this report for public review fulfills the requirements of Executive Order 11990, Section 2(b).

3. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: Not Applicable; project is located within the United States.

Executive Memorandum

1. Analysis of Impacts of Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: Not Applicable; project does not involve nor impact agricultural lands.

Smith Cove
Gloucester Harbor
Gloucester, Massachusetts

FINDING OF NO SIGNIFICANT IMPACT

XI. FINDING OF NO SIGNIFICANT IMPACT (FONSI)

After careful consideration of the information in this Environmental Assessment, it is my conclusion that the proposed Smith Cove Small Navigation Project is in the public interest, and will have no significant impact on the environment.

The proposed project entails deepening about a 2.5 acre anchorage at the head of Smith Cove. This would require the removal of approximately 33,000 cubic yards of dredged material. The dredged material would be disposed at the Foul Area Disposal Site in Massachusetts Bay.

This Environmental Assessment has been prepared in accordance with the National Environmental Policy Act of 1969, as amended. The determination that an Environmental Impact Statement is not required is based on the information contained in the Environmental Assessment including the following considerations:

1. The proposed project will have no significant effects on the water quality of Smith Cove;

2. There will be no significant impacts to threatened or endangered species in the project area;

3. The proposed project will have no significant impact on cultural, historical or archaeological resources.

Based on my evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that the Smith Cove Small Navigation Project, Gloucester, Massachusetts, is not a major Federal action significantly affecting the quality of the human environment and, therefore, is exempt from requirements to prepare an Environmental Impact Statement.

28 Feb 90
DATE

Daniel M. Wilson
Daniel M. Wilson
Colonel, Corps of Engineers
Division Engineer

Appendix EA-I
Sasaki Associates, Inc. 1983 Upland
Disposal Sites

List of Potential Disposal/Dewatering Sites

Community	Approximate Site I.D.	Property Owner Acreages (Ac.)	(If known)	Description
Gloucester	G-1	0.5	---	Located at head of the harbor mixed filled water's edge & tidal flats, portion used for parking
	G-2	1.0+[1]	State	Extension of State fish pier
	G-3	4.5[2]	---	Ten pound Island, possible expansion of island perimeter
	G-4	12.7	---	Fill behind Dogbar Breakwater

[1] Estimated, exact dimensions of extension not known.
[2] Represents area of Island, not area of possible shoreline extension.

Source: Based on a review of aerial photographs and telephone interviews with local government officials (Sasaki Associates, Inc. 1983.)

Potential Disposal Sites and Applicable Criteria for Determining Viability

Source: Sasaki Associates, Inc. 1983

Municipality: Gloucester

Site	G-1	G-2	G-3	G-4
Estimated Capacity (cubic yards)	12,000	27,400	589,400	1,100,000
Criteria(1)				
a. Economics	X	X	X	
b. Wetlands	X	X		
c. Accessibility				
d. Sensitive Receptors				
e. Historic Sites				
f. Natural Edge			X	
g. High Energy Coastal Site			X	
h. Threat to Water Supplies				
i. Property Owner Considerations				
Viability	No	No(2)	No(3)	Yes

Comments:
(1) Violation of a criterion is X.

(2) The use of dredge spoil as backfill for an extension of the State Fish Pier will add a significant premium cost to the project because confinement of the unconsolidated spoils will require use of cellular sheetpile coffer dams, as opposed to straight sheet pile. Therefore, the use of dredge spoil as backfill at this site would not be recommended. A small amount of spoil may be mixed with good granular fill, however, and possibly used at this site.

(3) Expansion of Ten Pound Island also will produce a potential hazard to navigation.

Appendix EA-II

1983 Bulk Sediment Analysis - Smith Cove

Gloucester, Massachusetts
1983 Smith Cove - Bulk Sediment Analysis

Station	A	A	A
Depth (ft.)	0.0 - 0.9	0.0 - 0.25	1.05 - 1.30
Soil Descrip.	organic gravelly sand silt		
Median Grain Size	0.0500	-	-
% Fines	55	-	-
Liquid Limit	73	-	-
Plastic Limit	39	-	-
Plastic Index	34	-	-
Specific Gravity	2.62	-	-
% Solids	-	37.2	58.2
Sediment pH	7.5	-	-
% Vol. Solids - EPA	-	11.63	5.25
% Vol. Solids - NED	-	9.95	4.12
Chemical Oxygen Demand (ppm)	-	133,450	50,450
Oil and Grease (ppm)	-	2,840	430
Mercury (ppm)	-	0.42	0.18
Lead (ppm)	-	273	58
Zinc (ppm)	-	290	129
Arsenic (ppm)	-	9.5	4.8
Cadmium (ppm)	-	2	<1
Chromium (ppm)	-	63	23
Copper (ppm)	-	221	36
Nickel (ppm)	-	<30	<30
Silver (ppm)	-	<25	<25
Vanadium (ppm)	-	<100-125	<100-125
% Carbon	-	5.01	-
% Hydrogen	-	0.78	-
% Nitrogen	-	0.44	-

Gloucester, Massachusetts
1983 Smith Cove - Bulk Sediment Analysis

Station	B	B	B
Depth (ft.)	0.0 - 0.80	0.0 - 0.25	0.8 - 1.04
Soil Descrip.	organic sandy clay		
Median Grain Size	0.0200	-	-
% Fines	77	-	-
Liquid Limit	55	-	-
Plastic Limit	24	-	-
Plastic Index	31	-	-
Specific Gravity	2.77	-	-
% Solids	-	43.1	54.6
Sediment pH	-	-	-
% Vol. Solids - EPA	-	9.64	6.32
% Vol. Solids - NED	-	7.34	4.78
Chemical Oxygen Demand (ppm)	-	86,550	88,100
Oil and Grease (ppm)	-	2,060	128
Mercury (ppm)	-	0.47	0.19
Lead (ppm)	-	226	16
Zinc (ppm)	-	399	75
Arsenic (ppm)	-	7.9	5.0
Cadmium (ppm)	-	<1	<1
Chromium (ppm)	-	51	15
Copper (ppm)	-	164	13
Nickel (ppm)	-	<30	<30
Silver (ppm)	-	<25	<25
Vanadium (ppm)	-	<100-125	<100-125
% Carbon	-	4.55	-
% Hydrogen	-	0.69	-
% Nitrogen	-	0.33	-

Gloucester, Massachusetts
1983 Smith Cove - Bulk Sediment Analysis

Station	C	C	C
Depth (ft.)	0.0 - 1.1	0.0 - 0.25	1.15 - 1.4
Soil Descrip.	organic sandy silt		
Median Grain Size	0.0180	-	-
% Fines	92	-	-
Liquid Limit	108	-	-
Plastic Limit	48	-	-
Plastic Index	60	-	-
Specific Gravity	2.59	-	-
% Solids	-	37.5	52.0
Sediment pH	7.4	-	-
% Vol. Solids - EPA	-	10.57	6.25
% Vol. Solids - NED	-	8.34	4.64
Chemical Oxygen Demand (ppm)	-	156,800	74,000
Oil and Grease (ppm)	-	2,900	870
Mercury (ppm)	-	0.33	0.35
Lead (ppm)	-	298	158
Zinc (ppm)	-	552	330
Arsenic (ppm)	-	11.3	9.8
Cadmium (ppm)	-	2	<1
Chromium (ppm)	-	79	47
Copper (ppm)	-	247	91
Nickel (ppm)	-	<30	<30
Silver (ppm)	-	<25	<25
Vanadium (ppm)	-	<100-125	<100-125
% Carbon	-	5.14	-
% Hydrogen	-	0.85	-
% Nitrogen	-	0.41	-

Gloucester, Massachusetts
1983 Smith Cove - Bulk Sediment Analysis

Station	D	D	D
Depth (ft.)	0.0 - 1.3	0.0 - 0.25	1.15 - 1.4
Soil Descrip.	organic sandy silt		
Median Grain Size	0.03200		
% Fines	92	-	-
Liquid Limit	132	-	-
Plastic Limit	60	-	-
Plastic Index	72	-	-
Specific Gravity	2.56	-	-
% Solids	-	37.4	35.2
Sediment pH	7.2	-	-
% Vol. Solids - EPA	-	11.63	9.22
% Vol. Solids - NED	-	8.73	6.25
Chemical Oxygen Demand (ppm)	-	154,300	101,100
Oil and Grease (ppm)	-	2,890	120
Mercury (ppm)	-	0.12	0.86
Lead (ppm)	-	275	16
Zinc (ppm)	-	412	175
Arsenic (ppm)	-	11.8	7.9
Cadmium (ppm)	-	<1	<1
Chromium (ppm)	-	83	37
Copper (ppm)	-	256	26
Nickel (ppm)	-	<30	<30
Silver (ppm)	-	<25	<25
Vanadium (ppm)	-	<100-125	<100-125
% Carbon	-	5.48	-
% Hydrogen	-	0.93	-
% Nitrogen	-	0.48	-

Gloucester, Massachusetts

1983 Smith Cove - Bulk Sediment Analysis

Station	E	E	E
Depth (ft.)	0.0 - 1.2	0.0 - 0.25	1.15 - 1.4
Soil Descrip.	organic sandy silt		
Median Grain Size	0.0230		
% Fines	82	-	-
Liquid Limit	93	-	-
Plastic Limit	45	-	-
Plastic Index	48	-	-
Specific Gravity	2.64	-	-
% Solids	-	35.4	68.2
Sediment pH	-	-	-
% Vol. Solids - EPA	-	10.17	2.60
% Vol. Solids - NED	-	8.10	1.39
Chemical Oxygen Demand (ppm)	-	128,700	33,300
Oil and Grease (ppm)	-	120	<100
Mercury (ppm)	-	0.20	<0.1
Lead (ppm)	-	238	16
Zinc (ppm)	-	321	109
Arsenic (ppm)	-	13.1	5.2
Cadmium (ppm)	-	<1	<1
Chromium (ppm)	-	65	33
Copper (ppm)	-	217	25
Nickel (ppm)	-	<30	<30
Silver (ppm)	-	<25	<25
Vanadium (ppm)	-	<100-125	<100-125
% Carbon	-	4.35	-
% Hydrogen	-	0.76	-
% Nitrogen	-	0.37	-

Gloucester, Massachusetts
1983 Smith Cove - Bulk Sediment Analysis

Station	F	F	F
Depth (ft.)	0.0 - 1.04	0.0 - 0.25	1.0 - 1.25
Soil Descrip.	organic sandy silt		
Median Grain Size	0.0300	-	-
% Fines	77	-	-
Liquid Limit	76	-	-
Plastic Limit	37	-	-
Plastic Index	39	-	-
Specific Gravity	2.65	-	-
% Solids	-	35.8	52.6
Sediment pH	7.0	-	-
% Vol. Solids - EPA	-	12.63	7.12
% Vol. Solids - NED	-	10.16	5.50
Chemical Oxygen Demand (ppm)	-	185,800	86,000
Oil and Grease (ppm)	-	9,340	1,640
Mercury (ppm)	-	0.28	0.43
Lead (ppm)	-	404	159
Zinc (ppm)	-	497	225
Arsenic (ppm)	-	8.2	6.9
Cadmium (ppm)	-	<1	<1
Chromium (ppm)	-	76	28
Copper (ppm)	-	315	96
Nickel (ppm)	-	<30	<30
Silver (ppm)	-	34	29
Vanadium (ppm)	-	<100-125	<100-125
% Carbon	-	7.65	-
% Hydrogen	-	1.25	-
% Nitrogen	-	0.75	-

Smith Cove, Gloucester, Massachusetts
PCB, DDT Analyses - Bulk Sediment
January 1984

Location	Depth Range, ft	Total PCB (ppb)	Total DDT (ppb)
A	0.0-1.9	85	<20
B	0.0-1.25	135	<20
C	0.0-1.4	87	<20
D	0.0-1.3	97	<20
E	0.0-0.8	77	<20
F	0.0-0.9	99	<20

Appendix EA-III

1985 Bulk Sediment Analysis - Smith Cove

Gloucester, Massachusetts
1985 Smith Cove - Bulk Sediment Analysis

Station	A	A	A	B	B
Depth (ft.)	0.1 - 1.45	0.0 - 0.25	1.3 - 1.55	0.0 - 1.4	0. 0 - 0. 25
Soil Descrip.	organic sandy silty clay	-	-	organic silt clay	-
Median Grain Size	0.32	-	-	0.0200	-
% Fines	80	-	-	90	-
Liquid Limit	94	-	-	119	-
Plastic Limit	40	-	-	46	-
Plastic Index	54	-	-	73	-
Specific Gravity	2.64	-	-	2.55	-
% Solids	-	38.9	52.8	-	28.2
Sediment pH	7.5	-	-	7.1	-
% Vol. Solids - EPA	-	10.13	5.46	-	15.23
% Vol. Solids - NED	-	7.72	3.48	-	11.87
Chemical Oxygen Demand (ppm)	-	139,000	37,000	-	206,000
Oil and Grease (ppm)	-	2,400	180	-	6,100
Mercury (ppm)	-	0.61	<0.05	-	0.76
Lead (ppm)	-	245	24	-	447
Zinc (ppm)	-	234	63	-	420
Arsenic (ppm)	-	11.7	3.9	-	6.2
Cadmium (ppm)	-	<2	<2	-	<2
Chromium (ppm)	-	51	25	-	82
Copper (ppm)	-	203	31	-	350
Nickel (ppm)	-	<21	<21	-	<21
Silver (ppm)	-	-	-	-	-
Vanadium (ppm)	-	<92	<92	-	97
% Carbon	-	4.25	2.63	-	7.11
% Hydrogen	-	0.78	0.54	-	1.19
% Nitrogen	-	0.38	0.20	-	0.60

Gloucester, Massachusetts
1985 Smith Cove - Bulk Sediment Analysis

Station	B	C	C	C
Depth (ft.)	1.25 - 1.5	0.0 - 1.4	0.0 - 0.25	0.0 - 0.8
Soil Descrip.	-	organic silty	-	-
	-	clay	-	-
Median Grain Size	-	0.0350	-	-
% Fines	-	63	-	-
Liquid Limit	-	98	-	-
Plastic Limit	-	39	-	-
Plastic Index	-	60	-	-
Specific Gravity	-	2.58	-	-
% Solids	48.3	-	47.1	59.6
Sediment pH	-	7.2	-	-
% Vol. Solids - EPA	7.87	-	8.86	6.16
% Vol. Solids - NED	5.50	-	4.58	3.42
Chemical Oxygen Demand (ppm)	113,000	-	88,800	70,000
Oil and Grease (ppm)	2,100	-	2,300	110
Mercury (ppm)	0.73	-	0.87	0.25
Lead (ppm)	257	-	295	191
Zinc (ppm)	247	-	256	184
Arsenic (ppm)	7.9	-	8.4	9.0
Cadmium (ppm)	<2	-	4	<2
Chromium (ppm)	41	-	23	29
Copper (ppm)	155	-	226	212
Nickel (ppm)	<21	-	<21	22
Silver (ppm)	-	-	-	-
Vanadium (ppm)	<92	-	<92	<92
% Carbon	3.75	-	6.58	2.78
% Hydrogen	0.67	-	0.71	0.58
% Nitrogen	0.29	-	0.40	0.29

Gloucester, Massachusetts
1985 Smith Cove - Bulk Sediment Analysis

Station	D	D	D	E
Depth (ft.)	0.0 - 0.8	0.0 - 0.25	1.75 -2.0	0.0 - 1.0
Soil Descrip.	organic sandy clayey silt	-	-	organic silty coarse to fine sand
Median Grain Size	0.0650	-	-	0.0900
% Fines	53	-	-	48
Liquid Limit	62	-	-	61
Plastic Limit	33	-	-	33
Plastic Index	29	-	-	28
Specific Gravity	2.62	-	-	2.60
% Solids	-	44.4	62.5	-
Sediment pH	7.4	-	-	7.0
% Vol. Solids - EPA	-	9.2	5.60	-
% Vol. Solids - NED	-	6.30	3.40	-
Chemical Oxygen Demand (ppm)	-	117,000	50,000	-
Oil and Grease (ppm)	-	5,100	170	-
Mercury (ppm)	-	1.0	0.06	-
Lead (ppm)	-	332	59	-
Zinc (ppm)	-	306	202	-
Arsenic (ppm)	-	7.7	2.6	-
Cadmium (ppm)	-	2	<2	-
Chromium (ppm)	-	23	20	-
Copper (ppm)	-	229	44	-
Nickel (ppm)	-	<21	<22	-
Silver (ppm)	-	-	-	-
Vanadium (ppm)	-	<92	<92	-
% Carbon	-	5.55	3.00	-
% Hydrogen	-	0.78	0.54	-
% Nitrogen	-	0.44	0.25	-

Gloucester, Massachusetts
1985 Smith Cove - Bulk Sediment Analysis

Station	E	E
Depth (ft.)	0.0 - 0.25	0.75 - 1.0
Soil Descrip.	-	-
Median Grain Size	-	-
% Fines	-	-
Liquid Limit	-	-
Plastic Limit	-	-
Plastic Index	-	-
Specific Gravity	-	-
% Solids	43.2	62.9
Sediment pH	-	-
% Vol. Solids - EPA	8.80	8.22
% Vol. Solids - NED	5.84	6.07
Chemical Oxygen Demand (ppm)	119,000	52,400
Oil and Grease (ppm)	190	76
Mercury (ppm)	0.77	<0.05
Lead (ppm)	276	<13
Zinc (ppm)	248	44
Arsenic (ppm)	4.3	2.2
Cadmium (ppm)	<2	<2
Chromium (ppm)	31	20
Copper (ppm)	175	19
Nickel (ppm)	<21	<21
Silver (ppm)	-	-
Vanadium (ppm)	<92	<92
% Carbon	4.94	2.24
% Hydrogen	0.62	0.43
% Nitrogen	0.30	0.20

PCB, DDT Results - Sediment
1985 Smith Cove

Location	PCB, ppb	DDT, PPB
A - Top	<60	<10
A - Bottom	<60	<10
B - Top	<60	<10
B - Bottom	<60	<10
C - Top	<60	<10
C - Bottom	<60	<10
D - Top	<60	<10
D - Bottom	<60	<10
E - Top	<60	<10
E - Bottom	<60	<10

Appendix EA-IV
Biological Report on Smith Cove in Gloucester, MA

IAB BR-86-8

Biological Report on Smith Cove in Gloucester, Massachusetts

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Introduction: On 13 August and 22 August 1986 the subtidal and intertidal benthic habitats of Smith Cove were quanitatively sampled. The purpose of this sampling effort was to obtain benthic community data that would assist in prediction of impacts associated with a proposed improvement dredging project. The proposed dredging would occur in the subtidal area indicated in Figure EA-IV-1 and a very narrow edge of the intertidal area.

Sampling of the intertidal zone was accomplished by establishing three stations along a transect proceeding from high intertidal (Station I) to low intertidal areas (Station III) (see Figure EA-IV-1). Subtidal stations were randomly generated and sampled remotely with a $0.04 m^2$ Van Veen sampling grab.

Smith Cove is located in Gloucester Harbor, Massachusetts at 42° 36' north latitude by 70° 40' west longitude in the southern Gulf of Maine. The mean tidal range is 2.61 meters with a spring maximum of 3.03 meters (N.O.A.A., 1986a). Tidal currents maximum flood is 154.3 cm/sec (3.0 knots) at 310° northwest and maximum ebb is 170.0 cm/sec (3.3 knots) at 130° southeast in the harbor (N.O.A.A., 1986b).

MATERIALS AND METHODS:

The location and quantity of samples were determined statistically. This sampling strategy was developed using the formula of Sokal and Rohlf (1981) to determine the number of replications needed to detect a given "true" difference between means. Previous sampling by the Massachusetts Audubon Society at MLW in Smith Cove indicated twelve replicates, for the silt dominated facies, are necessary to detect a 5% variance in population densities at a 0.90 level of statistical significance. A grouping of randomly generated stations identified four stations in the silty areas each with three replicates. Taking a fourth replicate in this sampling program reduces the likelihood of excessive variances.

This sampling regime assumes:

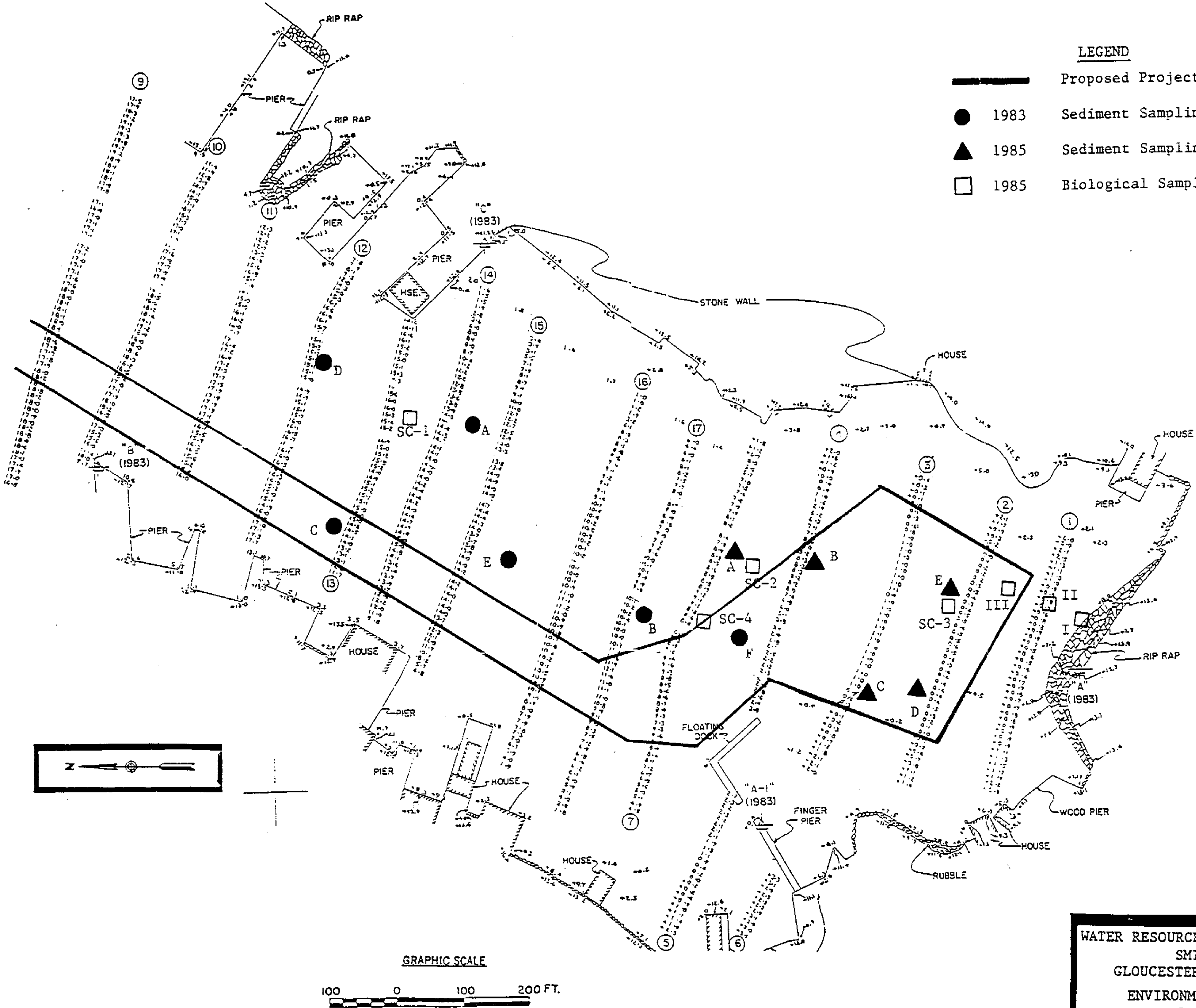
a. Uniform physical and chemical characteristics exist within each facies.

b. The densities of individuals will be similar to data collected by the Massachusetts Audubon Society for silt-dominated stations at 0 foot Mean Low Water in Smith Cove, Gloucester, Massachusetts.

c. The summer/fall (August-September) season will be representative of the impacted population.

d. Pre-dredging benthic data is applicable to post-dredging faunal recolonization.

e. A single classification Model I ANOVA will be used.



LEGEND

▬	Proposed Project Limits
● 1983	Sediment Sampling
▲ 1985	Sediment Sampling
□ 1985	Biological Sampling

WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

ENVIRONMENTAL SAMPLING
LOCATIONS EA IV-1

Sampling of the intertidal habitat occurred by placing three random 20cm by 20 cm grids, one meter part, on the substrate at three stations (I, II and III) along the transect. All epifaunal organisms within the grid were identified to species and enumerated. Where it was not possible to identify an organisms in the field, they were preserved in a 10% buffered formalin, labeled and returned to the laboratory for identification. Field notes were made of the substrate, algal cover and waterfowl present. Additionally 4 replicate one (1.0) liter hand cores were obtained at each station. These cores were forced into the substrate screened through 0.5mm sieve, labeled, placed in a jar, and preserved in 10% buffered formalin with rose bengal. The rose bengal is a bright red vital stain that allows for easy identification of living tissue when separating organisms from debris. The sample was allowed to stand for at least one week in the formalin and rose bengal solution and was then hand sorted and preserved in 70% ethyl alcohol. The whole organisms and anterior ends of partial organisms in the samples were taxonomically identified through microscopic techniques and the results are listed in Appendix I.

The subtidal environment of Smith Cove was remotely sampled with a $0.04m^2$ (1/25 of a square meter) Van Veen grab. This benthic sampler has proven the most efficient for substrates ranging in composition from silt to sand with 80 to 100% capture success rates. Another advantage of the Van Veen grab is its ability to evenly sample all representative organisms at the various depths in the substrate by having its jaws close on each other horizontally. This allows the sample to be classified as a unit of area instead of a volume (Wolff, 1973). These benthic samples were sieved through a 0.5mm screen, stained and preserved, and identified in the same manner as the hand cores.

Statistical analysis of the replicate hand cores and Van Veen grabs from each station provides a description of the benthic communities at that particular time of sampling. This analysis should not be construed as a finite description of the benthic community which would require seasonal sampling and additional stations. The inclusion of the calculation of Shannon (H' log 10) Diversity and Evenness (J'log 10) provides a static qualification of a dynamic community. Shannon Diversity value (H') is a unitless number that provides a qualitative expression of the distribution of observations among categories. In this case, the distribution or number of individuals amoung species. The maximum possible diversity attainable is a logarithmic function of the number of species present. Evenness (J') is the proportion of the observed diversity to the maximum attainable diversity and therefore an indication of homogeneity or relative diversity (see Results). These statistics are applied here only as descriptive reference between the stations samples.

Results: Subtidal

The subtidal habitat of Smith Cove was sampled at four (4) stations (SC-1, SC-2, SC-3 and SC-4). All four stations had similar densities and dominances except Station SC-3 which had a depauparate benthic community. The reason for these low numbers are most probably attributable to spatial heterogeneity, algal cover and/or local pollutant (oil) stresses (see Appendix).

Station SC-1 was randomly located in the proposed access channel to the anchorage area (see Figure 1). The four replicate Van Veen grabs were taken in 5 meters of water, with surface temperature of 18.5°C and a bottom temperature of 17.0 °C (see Table 9). Salinity ranged from 25.0 parts per thousand (0/00) on the surface to 26.1 0/00 at the bottom of the water column. The silty substrate had a hydrogen sulfide (H_2S) odor, a shallow (1mm) redox (reduction/oxidation discontinuity) layer and fine polychaete tubes evident. Analysis of the benthic community structure reveals approximately 7,706.25 organisms per square meter for 8 species. The clear dominant of this station is the tube dwelling, deposit feeding polychaete <u>Capitella capitata</u> in a density of 7,606.25 organisms per square meter. This opportunistic species represents 98.7% of all organisms recovered at this station. The Shannon Diversity Index (H') and associated Evenness (J') reflect an uneven distribution of data points (individuals) among categories (species). These values were 0.0399 for H' and 0.0442 for J' (see Discussion). In addition to the dominant polychaete, amphipod crustaceans (2 species), oligochaete annelids (2 species), polychaetes (2 species) and one species of gastropod were recovered.

Station SC-2 was randomly located in the middle of the cove where the channel expands to meet the proposed anchorage (see Figure 1). The grab samples were obtained in 4 meters of water with a surface temperature of 16°C (see Table 9). Salinity ranged from 27.9 0/00 at the surface to 28.0 0/00 just above the substrate. The silty substrate had a shallow (1mm) redox, surficial polychaete tubes and an H_2S odor. This station contained 8 species with an average density of 5,631.25 organisms per square meter. The extreme dominance of the polyhaetes <u>Capitella capitata</u> was also evident at this station, with the organism representing 97.0% of all individuals recovered. The Shannon Diversity Index (H') was 0.0824 and Evenness (J') 0.0913. These values reflect the monospecific dominance of <u>Capitella capitata</u> over the other species. In addition to the dominant polychaete, 4 species of polychaetes, one species of oligochaete, one species of amphipod crustacean and one species of gastropods were also recovered.

Station SC-3 was located closest to the intertidal area of the Cove in 2 meters of water. The surface sea temperature was 19.0°C with at 27.5 0/00. The bottom temperature was 17.0°C and salinity was 27.5 0/00. The silty substrate had a hydrogen sulfide odor, no redox layer and fine polychaete tubes present. Analysis of the benthic community revealed 8 species with an average density of 137.5 organisms per square meter. Dominance at this station is shared by four species, owing most probably to the overall low number of organisms present. The polychaete Capitella capitata (36.4%); the isopod crustecean Jaera marina (22.7%); the bivalue mollusc Mya arenarea (13.6%) and the gastropod mullusc Littorina littorea (9.1%) comprise 81.8% of all organisms present. The diversity indicies reflect the even distribution of individuals among species (H' = 0.7574 and J' = 0.8387) but are a function of the low density of organisms recovered. These species (Capitella capitata and Mya arenaria especially) are tolerant of stresses from dissolved oxygen reductions and various pollutants (Pearce and Rosenberg, 1978). The algae Ulva lactuca was present at these stations and is an associated habitat of the other dominants. The remaining 18.2 0/00 of the species were: Tellina agilis (6.25 0/00); Neris virens (6.25 0/00); Streblospio benedeni (6.25 0/00); and Oligochaeta spp. (6.25 0/00).

Station SC-4 was randomly located just outside the proposed project limits and is a benchmark against which our predictions of recruitment can be made. This station is also useful in determining whether those stations within the proposed dredging area contain unique assemblages of organisms. The replicate Van Veen samples were obtained in 3 meters of water with surface temperature of 18.5° and a 27.1 0/00 salinity. The bottom temperature was 16.0°C and the salinity was 28.0 0/00. The silty sediment contained numerous polychaete tubes, hydrogen sulfide odor and did not have a discernable redox. Analysis of the benthic community structure reveals approximately 4,231.25 organisms per square meter form 12 species. The extreme dominant is again Capitella capitata, representing 95.7% (4,050.0) of the total number of organisms per square meter. The H' and J' values reflect this extreme dominance at 0.1142 and 0.1058 respectively. In addition to the dominant polychaeta Capitella capita; 5 polychaete species, three gastropod species; two crustacean and one oligochaete species were recovered.

Discussion:

The Smith Cove subtidal habitat has an average density of 4,426.6 (S.D. = 3195.9) organisms per square meter from 18 species. The polychaeta Capitella capitata represents 93.3% of all organisms recovered. This organisms is know to withstand numerous environmental stresses. Many of the other species present, e.g. Streblospio benedicti, Peloscolex benedeni and Polydora ligni, are tolerant of low oxygen levels and an abundance of particulate organic matter (Pearce and Rosenberg, 1978). This type of highly tolerant species are considered "pioneering " organisms with short generation times (2-5 weeks), small whole organism size and high numbers of offspring (r-strategists of classical ecological theory). These assemblages of species are typical inhabitants of urban estuaries. There presence may be attributed to chemical stresses, the settling of large amounts of organic matter, or it also may be result of a depletion of available water column oxygen due to increasing water temperatures, local algal blooms and/or a increase of a chemical oxygen demand. It is evident that within the harbor the ambient temperature and salinities in August establish an 8.0 to 8.5 ppm oxygen saturation maximum. During quiescent wind/wave activity a strong thermocline could establish and reduce circulation within the harbor. This alteration in circulation patterns could synergically compound the above stresses. therefore establishing a potential for this effect.

Whatever the cause, the pioneering community is the most advantageous to dredge. Since station SC-4 is outside the project area and has a similar community as the remainder of the stations, it is a reasonable assumption that this community is dominant throughout the cove. It therefore can be predicted that three to four weeks after dredging the dominant species will have recolonized the substrate and within a few generations establish a community of similar equilibrium as that which presently exists in the project area.

Intertidal:

The intertidal benthic community of Smith Cove was sampled at three stations along a transect as indicated in the materials and methods section. This transect can be considered qualitatively applicable to any similar transect through the intertidal area at the southeastern end of Smith Cove.

Station I was located at the base of the rip-rap revetment on the backshore end of the cove. Samples taken here are representative of the upper mid-tidal area below the mean high water mark. The high water mark area is on the rock revetment and characterized by Fucus vesiculosus, Ulva lactuca and Ascophyllum nodosum. The macrobenthos present in the upper intertidal area adjacent to Station I are quantified in Table __. The station is dominated by cobble and silt substrates. The infaunal analysis of benthic had cores identified 15 species with 21,475 organisms per square meter. These organisms were dominated by the polychaete Streblospio benedicti (58.4%), Capitalla capitata (26.6%); Polydora ligni (5.3%) and Oligochaeta sp. (5.3%) comprising 95.5% of all individuals recovered. Calucation of H' equaled 0.5267 and J' of 0.4478, representing the codominance of these four species. The remaining 4.5% of the individual contained oligochaetes, polychaetes, bivalve and gastropod molluscs; crustaceans, rhynchocoels and plathhelminthes (see Table __). The benthos of commercial importance are the blue mussel, Mytilus edulis ($25/m^2$) and the clam, Mya arenria ($100/m^2$). Both of these densities are for spat or young of the year. These larger organisms were further sampled for using $20cm^2$ grids (see Material and Methods section) and only 24.9 Mya arenaria (mean length = 2.4 cm; std. dev. = 0.5) were recovered. This area will not be dredged, but the size and density of these shellfish indicate it is not a shellfish concentration area.

Station II, located at the midtidal level contained 15,650 organisms per square meter from 12 species. The dominant organisms were the polychaete Streblospio benedicti (91.5%); Mya arenaria (2.6%) and

Oligochaeta spp. (2.6%). The dominance of the tube-dwelling, suspension/surface deposit feeders is reflected in the narrow H' (0.1926) and J' (0.1786). The remaining 3.4% or the individuals contained 4 species of polychaetes, 2 species of bivalve molluscs, 1 species of gastropod molluscs, 1 species of oligochaete and 1 species of isopod crustacean. The presence of 400 Mya arenarea per square meter coincide with the set of larval bivalves after the spring/summer larval recruitment period. The presence of shellfish was further sampled for using the 20cm^3 grids. Samples taken at Station II revealed approximately 33.2 Mya arenaria/m^2 of a mean size of 2.0cm (s.d.=0.4). Mytilus edulis was also present attached to the cobble and boulder substrates in densities of approximately 672.3/m^2 with an average length of 3.9 cm (s.d.= 1.4). This area will not be impacted by dredging.

The sampling of Station III was performed to predict impacts of the dredging of 162 m^2 (0.04 acres) from this low intertidal area. The benthic had core replicates described a density of 21,475 organisms per square meter from 16 species. This benthic community was dominated by the polychaete Capitella capitata (65.3%); the oligochaete Pelosolex benedeni (19.0%); the polychaete Streblospio benedicti (40.0%); the amphipod crustacean Microdeutopus gryllotalpa (3.9%); and the oligochaete spp. (3.2%). The moderate distribution of dominances is evident in the Shannon Diversity Index value of 0.5130 and the Evenness value of 0.426. The remaining 4.6% of the individuals present at this station were from 6 species of bivalve molluscs and 1 species of rhyncocoela. The benthic community structure reveal 25 Mya arenaria per square meter and 75 Mytilus edulis per square meter. These were present as juveniles (set or spat) and analysis of the 20 cm^3 grid after sieving through a 1.0 mm sieve did not recover any shellfish. These low densities of juveniles do not constitute a significant assemblage of shellfish.

Intertidal.

The dominance of Streblospio benedicti, Capitella capitata and oligochaetes indicate the intertidal area of Smith Cove is stressed by the same physical, chemical or biological factors as the subtidal community. The shallower areas have varying densities of shellfish that are able to withstand estuarine stresses. The substrate consists of fine detrital particles accumulated among silt/clay sediments. This organically enriched environment stress the available oxygen concentrations of the habitat. In response to the oxygen depletion the tube dwelling and surface feeding pioneering organisms (e.g. Streblospio benedicti and Capitella capitata) proliferate, especially as bacterial metabolism generates a hydrogen sulphidic and anerobic substrate.

The lower intertidal area will potentially be impacted by dredging. All of the organisms present in this area (i.e. Station III) are also found subtidally, except for one. The presence of Microdeutopus gryllotalpa in the hand core at Station III is a function of its epifaunal, tube dwelling, suspension feeding mode of existence. Although not classically defined (Pearce and Rosenberg, 1978) as a pioneering organism, this mode of existence is synonomus with pioneering or colonization of stressed areas.

In summary, the dredging of the proposed 162 m^2 lower intertidal area will have no significantly different impact as predicted from dredging the subtidal habitat. The expected recolonization rates, and subsequent restoration of productivity levels, anticipated to occur in the subtidal habitat are also applicable to the lower intertidal zone.

Table 1. Dominant Species at Smith Cove. August 1985.

Station 1

Species	#/m²	
Capitella capitata	7606.25	(98.7%)
Total Nd =	7606.25	
d =	98.7%	

Station 2

Capitella capitata	5462.5	(97.0%)
Total Nd =	5462.5	
d =	97.0%	

Station 3

Capitella capitata	50	(36.4%)
Jaera marina	31.25	(22.7%)
Mya arenaria	18.75	(13.6%)
Littorina littorea	12.5	(9.1%)
Total Nd =	112.5	
d =	81.8%	

Station 4

Capitella capitata	4050	(95.7%)
Total Nd =	4050	
d =	95.7%	

Table 2. Dominant Species at Smith Cove August 1985.

Station I

Species	#/m²	
Streblospio benedicti	7750	(58.4%)
Capitella capitata	3525	(26.6%)
Polydora ligni	700	(5.3%)
Oligochaeta spp.	700	(5.3%)
Total Nd =	12,675	
d =	95.5%	

Station II

Streblospio benedicti	14,325	(91.5%)
Mya arenaria	400	(2.6%)
Oligochaeta spp.	400	(2.6%)
Total Nd =	15,125	
d =	96.6%	

Station III

Capitella capitata	14,700	(65.3%)
Peloscolex beneden	4275	(19.0%)
Streblospio benedicti	900	(4.0%)
Microdeutopus gryllotalpa	875	(3.9%)
Oligochaeta spp.	725	(3.2%)
Total Nd =	21,475	
d =	95.4%	

Table 3. Statistical Indices from benthic communities in Smith Cove in Gloucester, Ma (Subtidal 0.04m^2 Van Veen Samples).

Density and Richness

Total Number of Species = 8
Total Number of Individuals = 1233

Shannon Diversity Index
H' = .0399
J' = .0442

Margalef Diversity Index
Da = 2.2647

Menhinick Diversity Index
DB = .2278

Simpson Diversity Index
L = .0025

Simpson Dominance Index
S = .9975
Simpson Evenness
Es = 1.1391

* Station 1 Smith Cove

Density and Richness

Total Number of Species = 8
Total Number of Individuals = 901

Shannon Diversity Index
H' = .0824
J' = 9.129999E-02

Margalef Diversity Index
Da = 2.3691

Menhinick Diversity Index
DB = .2665

Simpson Diversity Index
L = .0032

Simpson Dominance Index
S = .9968
Simpson Evenness
Es = 1.1379

* Station 2 Smith Cove

Density and Richness
Total Number of Species = 8
Total Number of Individuals = 22

Shannon Diversity Index
H' = .7574
J' = .8387

Margalef Diversity Index
Da = 4.6937

Menhinick Diversity Index
DB = 1.4368

Simpson Diversity Index
L = .0245

Simpson Dominance Index
S = .9755
Simpson Evenness
Es = 1.0789
* Station 3 Smith Cove

Density and Richness
Total Number of Species = 12
Total Number of Individuals = 677

Shannon Diversity Index
H' = .1142
J' = .1058

Margalef Diversity Index
Da = 3.8861

Menhinick Diversity Index
DB = .4612

Simpson Diversity Index
L = .004

Simpson Dominance Index
S = .996
Simpson Evenness
Es = 1.0849
* Station 4 Smith Cove

Table 4. Statistical Indicies from benthic communities in Smith Cove in Gloucester, Ma. (Intertidal $0.01m^2$ hand cores)

Density and Richness

Total Number of Species = 15
Total Number of Individuals =531

Shannon Diversity Index
H' = .5267
J' = .4478

Margalef Diversity Index
Da = 5.1374

Menhinick Diversity Index
DB = .6509

Simpson Diversity Index
L = .0041

Simpson Dominance Index
S = .9959
Simpson Evenness
Es = 1.065

* Station I Smith Cove

Density and Richness

Total Number of Species = 12
Total Number of Individuals = 626

Shannon Diversity Index
H' = .1927
J' = .1786

Margalef Diversity Index
Da = 3.9334

Menhinick Diversity Index
DB = .4796

Simpson Diversity Index
L = .0042

Simpson Dominance Index
S = .9958
Simpson Evenness
Es = 1.0846

* Station II Smith Cove

Density and Richness

Total Number of Species = 16
Total Number of Individuals = 900

Shannon Diversity Index
H' = .513
J' = .426

Margalef Diversity Index
Da = 5.0774

Menhinick Diversity Index
DB = .5333

Simpson Diversity Index
L = .0027

Simpson Dominance Index
S = .9973
Simpson Evenness
Es = 1.0626

* Station III Smith Cove

Table 5. Number of benthic invertebrates per square meter recovered from Smith Cove ubtidal grab samples collected August 1985.

Station	1	2	3	4
MOLLUSCA				
Littorina littorea	.	.	12.5[4]	.
Gastropod juv.	6.25	.	.	.
Mya arenaria	.	6.25	18.75[3]	6.25
Mytilis spat	.	.	.	12.5
Tellina agilis	.	.	6.25	6.25
POLYCHAETA				
Capitella capitata	7606.25[1]	5462.5[1]	50[1]	4050[1]
Eteone heterpoda	.	31.25	.	.
Harmothoe imbricata	.	.	.	6.25
Microphthalmus sp.	.	.	.	25
Neries virens	.	37.5	6.25	31.25
Polydora lingi	31.25	31.25	.	62.5
Strebolspio benedicti	6.25	25	6.25	6.25
OLIGOCHAETA				
Peloscolex benedeni	12.5	25	.	6.25
Oligochaeta spp.	12.5	.	6.25	.
CRUSTACEA				
Cancer irroratus	.	.	.	6.25
Corophium insidiosum	25	12.5	.	12.5
Jaera marina	.	.	31.25[2]	.
Jassa falcata	6.25	.	.	.
Total Ni =	7,706.25	5631.25	137.5	4231.25
Nd (>95%) =	7606.25	5462.5	112.5	4050
dom =	98.7%	97.0%	81.8%	95.7%

Table 6. Number of benthic invertebrates per square meter recovered from Smith Cove intertidal core samples collected August 1985.

Station	I	II	III
PLATYHELMINTHES sp.	50	.	.
RHYNCHOCOELA			
Rhynchocoela S.	25	.	50
Mollusca			
Ilyanassa obsoleta	25	75	.
Macoma balthica	25	25	.
Mya arenaria	100	400[2]	25
Mytilis edulis	25	.	.
Mytilis spat	.	.	75
Tellina agilis	.	25	.
POLYCHAETA			
Capitella capitata	3525[2]	200	14,700[1]
Eteone heteropoda	.	25	.
Nepthys cacea	50	.	.
Neries virens	25	25	.
Phloe minuta	.	.	25
Phyllodoce maculata	.	.	25
Polydora aggregata	.	.	50
Polydora ligni	700[3]	.	450
Scolecolepides viridis	.	100	50
Schistomeringos (Stauroneries) sp.			25
Streblospio benedeni	7750[1]	14,325[1]	900[3]
OLIGOCHAETA			
Peloscolex benedeni	175	25	4275[2]
Oligochaeta spp.	700[3]	400[2]	725[5]
CRUSTACEA			
Corophium insidiosum	75	.	.
Gammarus oceanicus	.	.	225
Jaera marina	.	25	25
Jassa falcata	.	.	
Microdeutopus gryllotalpa	25	.	875[4]
Total Ni=	13,275	15,650	22,500
Nd (>95%) =	12,675	15,125	21,475
dom =	95.5%	96.6%	95.4%

Table 7. Intertidal benthic organisms recovered from 20x20cm grids excavated to 20cm and screened through a 1.0mm sieve. 22 August 1985. nith Cove in Gloucester, Massachusetts.

STATION #I

species	Grid A	Grid B	Grid C
Phylum Mollusca			
Class Gastropoda			
Littorina littorea			1
Ilyanassa obsoleta	2	1	
Class Bivalvia			
Mya arenaria ($\bar{x}$=2.4cm $\pm$0.5 s.d.)	3		
Phylum Annelida			
Class Polychaeta			
Nephtys cacea		1	
Nereis virens	3	1	2

Comments: Algal covered rocky intertidal area with Ulva lactuca, Fucus vesiculosus and Polyides caprinus. Ilyanassa obsoleta epifaunal on silty substrate with 1mm redox and Littorina littorea on sparse cobble and some shell fragments. Transect is 155^o from N.E.T. & T. Co. #250 utility pole on Rocky Neck Ave., at base of revetment.

Note: Avifauna present on the intertidal flat included: one (1) greater blackback gull; one (1) herring gull; one (1) cormorant, two (2) semi-palmated plovers (feeding); and one (1) snowy egret (feeding).

Table 8. Intertidal benthic organisms recovered from 20x20cm grids excavated to 20cm and screened through a 1.0mm sieve. 22 August 1985. Smith Cove in Gloucester, Massachusetts.

	STATION #II		
species	Grid D	Grid E	Grid F
Phylum Mollusca			
Class Gastropoda			
Littorina littorea	4	1	9
Class Bivalvia			
Mytilus edulis	58		23
($\bar{x}$=3.8cm^{+}/-1.3 s.d.)			$\bar{x}$=4.0cm^{+}/-1.5 s.d.)
Mya arenaria	4		
($\bar{x}$=2.0cm^{+}/-0.4 s.d.)			

Comments: Station #II located 22.3 meters from Station #I on the transect. The Mya arenaria were within the byssal threads of a blue mussel mat among some cobble.
Note: Station #III did not contain any macrobenthos retained on the 1.0mm sieve. Approximately 100 meters from toe of riprap.

Table 9. Intertidal benthic organisms recovered from 20x20cm grids xcavated to 20cm and screened through a 1.0mm sieve. 22 August 1985. Smith Cove in Gloucester, Massachusetts.

species	# per m^2 Station I	Station II
Phylum Mollusca		
Class Gastropoda		
Littorina littorea	8.3	116.2
Ilyanassa obsoleta	24.9	
Class Bivalvia		
Mytilus edulis (x=3.9cm +/-1.4 s.d.)		672.3
Mya arenaria	24.9 (x=2.4cm +/-0.5 s.d.)	33.2 (x=2.0cm +/-0.4 s.d.)
Phylum Annelida		
Class Polychaeta		
Nephtys cacea	8.3	
Nereis virens	49.8	
Ni = # of individuals/m^2 =	11.62	821.7
Ns = # of species/m^2 =	5	3

Table 9.
Temperature (^oC) and Salinity (ppt) Data
Smith Cove, Gloucester, Massachusetts
August 13, 1985

Station SC-1 10:05 a.m.
Depth - 5 meters

	Temp. ^oC	Salinity ppt
Surface	18.5°	25
1 meters	17.5°	26.1
2 meters	16.0°	27.9
3 meters	16.0°	27.9
4 m	17.0°	27.0
5 m	17.0°	27.0

Notes: Redox ≤1mm
Fine polychaete (?) tubes
H_2S

Station SC-2 10:25 a.m.
Depth - 4 m

	Temp. ^oC	Salinity ppt
Surface	18.5°	27.9
1 m	18°	27.1
2 m	17.9°	27.0
3 m	17.1°	27.1
4 m	16.0°	28

Notes: 1 *Limulus* 9cm. ("B" grab)
other characteristc same as SC-1

Station SC-3 10:45 a.m.
Depth - 2 m

	Temp. ^oC	Salinity ppt
Surface	19.0°	27.5
1 meters	18.1°	27.5
2 meters	17.0°	27.5

Notes: Same as SC-2, SC-1, but 0 redox
Fish activity

Station SC-4   11:00 a.m.
Depth - 3 m

	Temp. °C	Salinity ppt
Surface	18.5°	27.1
1 m	17.9°	28.0
2 m	17.0°	27.5
3 m	16.0°	28.0

Notes: Same as SC-3

Table 10.
Inner Harbor Temperature and Salinity Profile
Gloucester, Massachusetts
August 13, 1985, 11:15 a.m.

	Temp. °C	Salinity ppt
Surface	19.0°	26.0
1 m	18.5°	27.0
2 m	18.5°	26.5
3 m	18.0°	27.0
4 m	17.5°	27.0
5 m	16.5°	27.0
6 m	16.5°	27.0
7 m	16.0°	27.5
8 m	15.5°	27.5
9 m	15.0°	26.0
10 m	14.0°	27.5

Appendix I
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Benthic Analysis

INTERTIDAL AND SUBTIDAL BENTHIC INVERTEBRATES FROM SMITH COVE, GLOUCESTER, MASSACHUSETTS

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ASA 85-25

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Applied Science Associates, Inc. has identified and counted benthic invertebrates from three harbors in Massachusetts under Contract Number DACW-33-86-Q-0015. Information on subtidal and intertidal samples taken in Smith Cove, Goucester is presented in this report. Data from other harbors has been submitted previously.

Methods

Samples were collected, sieved, and preserved by New England Division, Corps of Engineers personnel. In the laboratory, large organisms and debris were removed from the samples by sieving on a 2 mm screen. Organisms were removed from the coarse fraction by sorting from a glass tray with a white background. The fine fraction between 2 mm and 0.5 mm was sorted under binocular microscopes. Organisms were identified to species in most cases, counted, and preserved in alcohol. The residue was described and discarded.

Most of the sorting was done by research assistants with several years experience and no resorting was considered necessary for material on which they had worked. Material sorted by less experienced workers was examined by the laboratory supervisor. All lots of identified organisms were examined by the laboratory supervisor.

Results

Counts are given in Tables 1 and 2. Descriptions of sample residues are given in Table 3. Taxonomic listings are given in Table 4.

No sample 3-C or 3-D were found in the subtidal collection. It was assumed that 5-D was actually 3-D and that 3-C was labeled as another sample from station 3.

The subtidal samples were all poorly preserved. The dominant species (the polychaete Capitella capitata) was flaccid and missing the posterior end of its body, but could be identified from thoracic setae. For most other species it is believed that an identifiable portion remained of each individual.

The sieve residues from subtidal stations 1 and 2 and sample 4-A contained only fine plant detritus. All other subtidal and intertidal samples contained broken shells of *Littorina*, *Mya*, *Mytilus*, and some times *Ilyanassa*. Samples 2-C, I-4, and III-1 contained the green algae *Ulva*. Samples 2-C, III-3, and III-4 were contaminated with petroluem.

Most of the species recovered were estuarine endemics, adapted to conditions of variable salinity and temperature. The presence of the large amphipod *Gammarus oceanicus* reflects the fully marine enviornment in the nearby outer harbor.

Capitella capitata was the only abundant species in the subtidal samples. Other species which are known to be adapted to low oxygen and an abundance of organic particulate matter were present only at low densities, suggesting very poor habitat quality. Even *Capitella* was reduced at station 3.

Larger numbers of species and individuals were found in intertidal samples. In addition to *Capitella*, important taxa were *Mya*, *Polydora*, *Streblospio*, and *Oligochaeta*. All of these taxa are adapted for existence in stressed environments where more sensitive competitors or predators are suppressed. All living *Mya* (softshell clams) were recently set spat. The amphipods *Gammarus* and *Microdeutopus* were probably associated with macroalgae at station III. The extreme variation in density of dominant species within stations suggests small-scale patchiness of the habitat.

Table 1. Number of benthic invertebrates recovered from Smith Cove subtidal grab samples collected August 1985.

Station	1				2				3				4			
Sample	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MOLLUSCA																
Littorina littorea	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
gastropod juv.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mya arenaria	.	.	.	.	1	.	.	.	2	1	.	.	.	.	1	.
Mytilis spat	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.
Tellina agilis	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.
POLYCHAETA																
Capitella capitata	303	448	252	214	40	92	140	602	5	.	.	3	207	231	146	64
Eteone heteropoda	.	.	.	.	3	.	1	1	.	.	.	.	.	.	.	.
Harmothoe imbricata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Microphthalmus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	.
Neries virens	.	.	.	.	.	3	3	.	.	1	.	.	1	2	1	1
Polydora ligni	.	5	.	.	4	.	.	1	.	.	.	.	4	6	.	.
Streblospio benedicti	.	1	.	.	.	2	2	.	6	4	.	.	.	1	.	.
OLIGOCHAETA																
Peloscolex benedeni	.	2	.	.	1	1	1	1	.	.	.	.	.	.	1	.
Oligochaeta spp.	.	2	.	.	.	.	.	.	.	1	.	.	.	.	.	.
CRUSTECEA																
Cancer irroratus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Corophium insidiosum	1	3	.	.	.	1	1	.	.	.	.	.	2	.	.	.
Jaera marina	.	.	.	.	.	.	.	.	4	.	.	1	.	.	.	.
Jassa falcata	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.

EA-IV 1c

Table 2. Number of benthic invertebrates recovered from Smith Cove intertidal core samples collected August 1985.

Station	I				II				III			
Sample	1	2	3	4	1	2	3	4	1	2	3	4
Bottle	1	2	3	4	5	6	7	8	9	10	11	12
PLATYHELMINTHES sp.	1	1	.	.	.	.	.	.	.	.	.	.
RHYNCHOCOELA												
Rhynchocoela.S	.	.	.	1	.	.	.	.	1	1	.	.
MOLLUSCA												
Ilyanassa obsoleta	1	.	.	.	.	1	1	1	.	.	.	.
Macoma balthica	.	.	1	.	.	.	.	1	.	.	.	.
Mya arenaria	.	1	2	1	4	5	4	3	.	.	1	.
Mytilis edulis	.	.	1	.	.	.	.	.	.	.	.	
Mytilis spat	.	.	.	.	.	.	.	.	.	1	2	.
Tellina agilis	.	.	.	.	.	.	.	1	.	.	.	.
POLYCHAETA												
Capitella capitata	5	1	1	134	2	.	2	4	8	153	406	21
Eteone heteropoda	.	.	.	.	.	1	.	.	.	.	.	.
Nepthys cacea	1	1	.	.	.	.	.	.	.	.	.	.
Neries virens	.	.	1	.	1	.	.	.	.	.	.	.
Phloe minuta	.	.	.	.	.	.	.	.	.	1	.	.
Phyllodoce maculata	.	.	.	.	.	.	.	.	.	1	.	.
Polydora aggregata	.	.	.	.	.	.	.	.	.	1	1	.
Polydora ligni	5	.	1	22	.	.	.	.	2	5	9	2
Scolecolepides viridis	.	.	.	.	1	2	1	.	.	.	1	1
Schistomeringos (Stauroneries) sp.	.	.	.	.	.	.	.	.	1	.	.	.
Streblospio benedicti	87	65	157	1	204	112	139	118	.	4	1	31
OLIGOCHAETA												
Peloscolex benedeni	1	.	1	5	1	.	.	.	.	24	144	3
Oligochaeta spp.	19	.	9	.	12	1	3	.	.	.	29	.
CRUSTACEA												
Corophium insidiosum	.	.	.	3	.	.	.	.	.	.	.	.
Gammarus oceanicus	.	.	.	.	.	.	.	.	.	4	5	.
Jaera marina	.	.	.	.	.	.	.	1	.	.	.	1
Jassa falcata	.	.	.	.	.	.	.	.	.	.	.	.
Microdeutopus gryllotalpa	.	.	.	1	.	.	.	.	9	28	.	.

Table 3. Description of residue from Smith Cove benthic samples.

Sample	Volume (cc)	Description
Subtidal		
1-A	100	1-A, 1-B, 1-D contained fine plant detritus with a little fine shell material. 1-C contained mostly *Mytilus* shells.
1-B	100	
1-C	600	
1-D	100	
2-A	100	all contained fine plant detritus with a small amount of fine shell material. 2-C contained *Ulva* and oil.
2-B	100	
2-C	200	
2-D	175	
3-A	350	all contained broken shell, entire *Littorina*, *Mya*, and *Mytilus* shells, and some fine plant detritus.
3-B	500	
3-C	-	
3-D	300	
4-A	150	4-A contained fine plant detritus, the remaining samples also contained fine shell and broken shell of *Littornia*, *Mya*, and *Mytilus*.
4-B	575	
4-C	650	
4-D	300	
Intertidal		
I-1	200	all samples contained mainly fine organic debris with some broken and some entire shells of *Mya*, *Mytilus*, *Littornia*, and *Ilyanassa* and with some rock fragments. I-4 contained *Ulva*.
I-2	300	
I-3	200	
I-4	600	
II-1	350	All similar to station I, no algae.
II-2	200	
II-3	200	
II-4	200	
III-1	400	All similar to stations I and II but with more shell material. *Ulva* in III-1, oil in III-3 and III-4.
III-2	800	
III-3	650	
III-4	200	

Table 4. Taxonomic list of benthic invertebrates recovered from Smith Cove samples with notes on life forms and feeding types.

PHYLUM PLATYHELMINTHES	
Platyhelminthes sp.	motile epifauna, predator
PHYLUM RHYNCHOCOELA	
Rhynchocoela S	burrowing predator
PHYLUM MOLLUSCA	
Class Gastropoda	
Ilyanassa obsoleta	motile epifauna, scavenger/deposit feeder
Class Bivalvia	
Macoma balthica	infauna, surface deposit feeder
Tellina agilis	infauna, surface deposit feeder
Mercenaria mercenaria	infauna, suspension feeder
Mya arenaria	infauna, suspension feeder
Mytilis edulis	epifauna, suspension feeder
PHYLUM ANNELIDA	
Class Polychaeta	
Family Phyllodocidae	epifauna, predators
Phyllodoce maculata	
Etone heteropoda	
Family Polynoidae	
Harmothoe imbricata	epifauna scavenger/predator
Family Siglionidae	
Pholoe minuta	epifauna scavenger/predator
Family Nephtyidae	
Nephtys caeca	burrowing predator
Family Hesionidae	
Microphthalmus sp.	epifauna predator
Family Nereidae	
Nereis virens	burrowing predator/scavenger
Family Capitellidae	
Capitella capitata	tube-dwelling deposit feeder
Notomastus luridus	burrowing deposit feeder
Family Spionidae	tube-dwelling suspension/surface deposit feeders
Streblospio benedicti	
Polydora aggregata	
Polydora ligni	
Scolecolepides viridis	
Class Oligochaeta	burrowing deposit feeders
Oligochaeta spp.	
Peloscolex benedeni	

PHYLUM ARTHROPODA	
Class Crustacea	
Superorder Peracarida	
Order Isopoda	
Jaera marina	motile epifauna, selective deposit feeder
Order Amphipoda	
Corophium insidiosum	tube-dwelling suspension feeder
Gammarus oceanicus	motile epifaunal omnivore
Jassa falcata	tube-dwelling suspension feeder
Microdeutopus gryllotalpa	epifaunal tube-dwelling suspension feeder
Superorder Eucarida	
Order Decapoda	
Infraorder Brachyura	
Cancer irroratus	motile epifaunal predator

Appendix EA-V
1983 Elutriate Test Data

ELUTRIATE TESTING - Smith Cove, Gloucester, Massachusetts

December 1983

Results of tests performed on: (1) the standard elutriate prepared from one part sediment taken at various sampling locations with four parts water from each sampling location and (2) the virgin water from each sampling location are as follows:

Test Property	Dredge Site Water Location A	Standard Elutriate Designation and Sediment Depth Used in Preparation Location "A" 0.0-1.9'			Dredge Site Water B	Standard Elutriate Designation and Sediment Depth Used in Preparation Location "B" 0.0-1.25'		
		R1	R2	R3		R1	R2	R3
Nitrate/Nitrite Nitrogen(N), ppm	< 0.02	< 0.02	<0.02	<0.02	< 0.02	< 0.02	< 0.02	< 0.02
Ammonia nitrogen (N), ppm	0.57	0.60	0.70	1.24	0.52	0.65	0.32	0.84
Sulfate (SO_4), ppm	2,800	2,600	2,600	2,800	2,800	2,700	2,700	2,700
Oil and grease, ppm	< 2.0	3.1	<2.0	2.2	<2.0	2.3	<2.0	3.1
Phosphorus								
ortho, ppm	0.06	< 0.01	< 0.01	< 0.01	0.05	< 0.01	< 0.01	< 0.01
total, ppm	0.09	< 0.01	<0.01	< 0.01	0.09	< 0.01	< 0.01	< 0.01
Mercury (Hg), ppb	<0.5	< 0.5	<0.5	< 0.5	<0.5	<0.5	<0.5	< 0.5
Lead (Pb), ppb	7.5	< 2	5.5	2.4	2.2	11.3	< 2	29.6
Zinc (Zn), ppb	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Arsenic (As), ppb	< 1.7	2.3	< 1.7	1.7	< 1.7	1.7	< 1.7	< 1.7
Cadmium (Cd), ppb	3.3	4.6	<0.5	5.0	5.0	2.3	10.2	3.9
Chromium (Cr), ppb	<1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Copper (Cu), ppb	3.8	5.3	1.8	24.3	4.2	<1.5	1.7	<1.5
Nickel (Ni), ppb	4.2	3.1	<3	< 3	<3	8.7	< 3	< 3
Vanadium (V), ppb	18.9	25.1	< 5	< 5	18.4	< 5	12.3	< 5
Total PCB, ppb								
Total DDT, ppb								

ELUTRIATE TESTING - Smith Cove, Gloucester, Massachusetts
December 1983

Results of tests performed on: (1) the standard elutriate prepared from one part sediment taken at various sampling locations with four parts water from each sampling location and (2) the virgin water from each sampling location are as follows:

	Dredge Site Water	Standard Elutriate Designation and Sediment Depth Used in Preparation Location "C" 0.0-1.5			EPA Water Quality Criteria, 1976, 1980 (any one time)
	C	R1	R2	R3	
Test Property					
Nitrate/Nitrite Nitrogen(N), ppm	0.04	<0.02	<0.02	<0.02	10
Ammonia nitrogen (N), ppm	0.31	1.42	0.50	1.65	0.2
Sulfate (SO_4), ppm	2,700	2,600	1,300	2,600	-
Oil and grease, ppm	<2.0	2.2	2.1	<2.0	-
Phosphorus					
ortho, ppm	0.04	<0.01	<0.01	<0.01	0.10
total, ppm	0.08	<0.01	<0.01	<0.01	0.10
Mercury (Hg), ppb	<0.5	<0.5	<0.5	<0.5	3.7
Lead (Pb), ppb	<2	<2	2.4	<2	25
Zinc (Zn), ppb	<20	<20	<20	<20	170
Arsenic (As), ppb	<1.7	<1.7	<1.7	<1.7	508 (acute)
Cadmium (Cd), ppb	6.8	5.4	5.3	2.5	59
Chromium (Cr), ppb	<1	<1	<1	<1	126
Copper (Cu), ppb	2.5	2.2	5.5	<1.5	23
Nickel (Ni), ppb	4.1	<3	11.2	3.5	140
Vanadium (V), ppb	59.7	<5	<5	29.6	-
Total PCB, ppb					
Total DDT, ppb					

EA-V2

Appendix EA-VI
1985 Elutriate Test Data

ELUTRIATE TESTING - Smith Cove, Gloucester, Massachusetts
August 1985

Results of tests performed on: (1) the standard elutriate prepared from one part sediment taken at various sampling locations with four parts water from the center of the dredging site and (2) water from the center of dredging site are as follows:

	Dredge Site Water	Standard Elutriate Designation and Sediment Depth Used in Preparation Location "A" 0.0-1.35 ft			Dredge Site Water	Standard Elutriate Designation and Sediment Depth Used in Preparation Location "E" 0.0-0.7 ft		
		R1	R2	R3		R1	R2	R3
Nitrate/Nitrite Nitrogen(N), ppm	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sulfate (SO_4), ppm	2370	2180	2072	2125	2370	2235	2125	2125
Oil & Grease, ppm	< 0.3	1.61	0.84	0.60	< 0.3	0.99	1.88	0.85
Phosphorus								
ortho, ppm	0.02	0.21	0.27	0.10	0.02	0.02	0.01	0.02
total, ppm	0.06	0.30	0.37	0.18	0.06	0.09	0.07	0.08
Mercury (Hg), ppb	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lead (Pb), ppb	4	< 2	< 2	< 2	4	< 2	< 2	< 2
Zinc (Zn), ppb	20	< 15	< 15	< 15	20	< 15	< 15	< 15
Arsenic	< 2	6.0	9.3	6.7	< 2	< 2	< 2	< 2
Cadmium (Cd), ppb	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chromium (Cr), ppb	1.4	1.2	2.0	1.2	1.4	1.2	7.4	1.2
Copper (Cu), ppb	27.5	34.8	44.0	13.0	27.5	14.0	10.8	23.0
Nickel (Ni), ppb	< 2	< 2	14	< 2	< 2	20	4.1	3.5
Vanadium (V), ppb	7	11	26	18	7	5	6	6
Total PCB, ppb	0.05	0.07	0.08	0.11	0.05	0.10	0.70	0.19
Total DDT, ppb	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

1985
PCB, DDT Results - Sediment
Smith Cove

Location	PCB, ppb	DDT, ppb
A - Top	<60	<10
A - Bottom	<60	<10
B - Top	<60	<10
B - Bottom	<60	<10
C - Top	<60	<10
C - Bottom	<60	<10
D - Top	<60	<10
D - Bottom	<60	<10
E - Top	<60	<10
E - Bottom	<60	<10

Appendix EA-VII
Bioassy/Bioaccumulation Report

ECOLOGICAL EVALUATION OF PROPOSED OCEANIC DISCHARGE OF DREDGED MATERIAL FROM SMITH COVE, GLOUCESTER, MASSACHUSETTS

Contract No. DACW33-83-M-0957

Prepared for:

New England Division, Corps of Engineers
Department of the Army
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Attention: NED Materials and Water Quality Laboratory

Prepared by:

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February 1984

SUMMARY

The proposed oceanic discharge of dredged material from Smith Cove, Gloucester, Massachusetts, to the Boston Foul Grounds Disposal Site is ecologically acceptable judged by the toxicity-related criteria employed in this evaluation. Total (combined) survival of appropriate, sensitive, benthic marine organisms exposed for 10 days to the solid phase of dredged material was not significantly lower (α=0.05) than survival of reference organisms.

Tissues of benthic organisms that survived exposure to the solid phase of dredged material from the study area usually did not contain significantly elevated (α=0.05) concentrations of analyzed constituents (cadmium, mercury, polychlorinated biphenyls, the dichloro-diphenyl-trichloroethane family, and aliphatic and aromatic petroleum hydrocarbon fractions) as compared to tissues of reference organisms. Only one of the bioaccumulation tests performed during the evaluation - PCBs in grass shrimp- indicate a statistical potential for bioaccumulation.

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Appendix

A. Laboratory Procedures For Preparing Dredged Material And Conducting Bioassays

B. Unanalyzed Bioassay-Related Data

INTRODUCTION

The major objective of this evaluation is to assess the ecological acceptability of the proposed oceanic discharge of dredged material from Smith Cove, Gloucester, Massachusetts, to the Boston Foul Grounds Disposal Site. If the proposed discharge is judged to be ecologically acceptable according to the bioassay and bioaccumulation related criteria employed in the evaluation, the disposal practice is considered to be in partial compliance with Subpart B (Environmental Impact) of the ocean dumping regulations (U.S. EPA, 1977).

Subpart B (Environment Impact) of the ocean dumping regulations consist of the following basic sections: 227.5 (Prohibited Materials); 227.6 (Constituents Prohibited as Other than Trace Contaminants); 227.7 (Limits Established for Specific Wastes or Waste Constituents); 227.8 (Limitations on the Disposal Rates of Toxic Wastes); 227.9 (Limitations on Quantities of Waste Materials); 227.10 (Hazards to Fishing, Navigation, Shorelines or Beaches); 227.11 (Containerized Wastes); and 227.12 (Insoluble Wastes); and 227.13 (Dredged Materials). Disposal of dredged material must comply with restrictions and limitations imposed by 227.5, 227.6, 227.9, 227.10, and 227.13 of the regulations (U.S. EPA, 1977). Compliance of the material with toxicological (bioassay-based) and bioaccumulation-related criteria identified in 227.6 (Constituents Prohibited as Other than Trace Contaminants) and 227.13 (Dredged Material) of the regulations is addressed in this evaluation.

The evaluation consists of five principal sections in addition to the Introduction. The first section, which precedes the Introduction, summarized the ecological acceptability of the proposed discharge operation. The second section reviews the methods and materials employed in the evaluation. The third section presents important results of the evaluation, while the fourth section consists of a discussion of these results. The fifth section contains references cited in the evaluation.

The evaluation contains two appendices. Appendix A details laboratory procedures employed for preparing dredged material and conducting bioassays. The appendix also serves as a quality-control document. Appendix B contains all raw bioassay related data. Only data directly relevant to the ecological evaluation of the proposed discharge operation are presented in the main body of the evaluation.

METHODS AND MATERIALS

Toxicological (bioassay) and bioaccumulation studies of the solid phase of the dredged material were conducted according to the guidelines presented in the Appendices of the manual entitled Ecological Evaluation of Proposed Discharge of Dredged Materials into Ocean Waters (U.S. EPA and U.S. Army COE, 1977). Laboratory procedures employed for preparing dredged material and conducting bioassays are detailed in Appendix A. Bioassays were conducted at the Sea Plantations Aquaculture Facility in Salem, Massachusetts. Bioaccumulation studies were performed with organisms that survived the solid phase bioassays. Tissues of these organisms were analyzed for constituents prohibited as other than trace contaminants by the ocean dumping regulations (U.S. EPA, 1977); cadmium, mercury, polychlorinated biphenyls, the dichloro-diphenyl-trichloroethane family, and aliphatic and aromatic petroleum hydrocarbons. Cadmium and mercury analyses were performed at the SP, Inc. Laboratory in Salem, Massachusetts. Polychlorinated biphenyls, the dichloro-diphenyl-trichloroethane family, and aliphatic and aromatic petroleum hydrocarbon analyses were performed at Cambridge Analytical Associates, Watertown, Massachusetts.

All proposed dredged material and reference and control sediments were collected by Army Corps of Engineers Personnel. Dredged material proposed for oceanic discharge was collected from Smith Cove, Gloucester, Massachusetts on September 13, 1983. Reference sediment used in the solid phase bioassay was collected from the Disposal Site on September 12, 1983. Control sediment employed in the tests was also collected September 13, 1983. The proposed dredged material, reference sediment, and control sediment were delivered to Linda A. Laas of SP, Inc. at the Sea Plantations Aquaculture Facility on September 15, 1983. All samples were placed upon receipt in cold storage (2-4°C) until use.

Species tested in the solid phase bioassay were the grass shrimp (*Palaemonetes pugio*), hard clam (*Mercenaria mercenaria*), and the sandworm (*Nereis virens*) Grass shrimp and hard clams were obtained from the stock organisms maintained on biological filter systems by Sea Plantations, Inc. Sandworms were acquired from a commercial supplier in Wiscasset, Maine, and were acclimated on a biological filter system for at least four days prior to the initiation of testing. All species were tested in the same aquaria. Aeration was maintained throughout testing in all tanks. Testing temperature was $20 \pm 1^\circ$C. Water exchange was by the flow-through method. A minimum flow of 250 ml/minute was maintained in each tank.

At the conclusion of the solid phase bioassays all surviving organisms from each aquarium were placed in an aquaium containing clean, sediment-free water and allowed to void their digestive system. A mesh divider was used to separate the sandworms from the grass shrimp in order to prevent predation by the grass shrimp. Organisms were maintained in the aquarium for a period of two days, during which the constant aeration and the flow through water exchange conditions continued. During this time, fecal material was removed from the aquaria. At the end of the two-day period, all samples of the organisms were removed from the aquaria. All organisms were placed into polyethylene WHIRL PAK bags, and frozen for later analyses. The shells of hard clams were removed prior to freezing.

Tissue samples were analyzed for two metals - cadmium (Cd) and mercury (Hg) -- according to procedures described by the American Public Health Association (1980). For the analyses for Hg, a separate aliquot of wet, homogenized tissue was placed in a 300-ml BOD bottle. Five ml of concentrated nitric acid, 10 ml of potassium permanganate, and 10 ml of potassium persulfate were placed in the bottle and the sample was heated at 70°C in a water bath for four hours until the tissue was completely digested. The analysis was performed on an IL 457 Atomic Absorption Spectrophotometer equipped with an IL 440 Automatic Vapor Analyzer. In the analyses for Cd, an aliquot of wet, homogenized tissue was placed in a 100 ml Pyrex beaker with 5 ml of concentrated nitric acid and 10 ml distilled water and refluxed until the tissue was completely digested. Following digestion, the sample was cooled, filtered by vacumn suction filtration, diluted to volume with distilled water, and analyzed by atomic absorption spectrophotometry. Procedural blanks and standards were evaluated using the same methods employed for tissue samples.

Tissue samples were analyzed for three types of organics - polychlorinted biphenyls (PCBs), the dichloro - diphenyl - trichloroethane family (DDT, DDE, and DDD) and aliphatic and aromatic petroluem hydrocarbon fractions by Cambridge Analytical Associates of Watertown, Massachusetts. Analytical procedures followed those described by the Food and Drug Administration (1977) and Warner (1976). In summary, a 5 gram sample of tissue was digested with potassium hydroxide. The digestate was extracted with hexane, which was dried and cleaned up with a silica gel precolumn. One aliquot of the cleaned extract was analyzed for PCBs and DDT by gas chromatography/electron capture detection. A second aliquot was fractionated by silica gel column chromatography into saturated and aromatic fractions, each of which were analyzed for hydrocarbons by gas chromatography/flame ionization detection.

Precision of analytical techniques is indicated in Table 6. Triplicate tissue analyses were carried out on all species from subsamples of organisms that were employed in the bioassays (Pre-Test Tissue) and on organisms exposed to the control sediment in the bioassay. Spike Recovery Studies showed a recovery of 97 percent for mercury by cold vapor atomic absorption spectroscopy and 93 percent for cadmium by atomic absorption spectroscopy. As a part of normal laboratory procedures blanks and standards were interspersed with every fifth sample for both mercury and cadmium. Results of all analyses of blank samples are presented in Tables 3 to 5.

Results of the bioassay and bioaccumulation studies were interpreted by statistical techniques recommended by the U.S. EPA and U.S. Army COE (1977). When warranted, each data set generated in the studies was evaluated by Cochran's tests to determine if variances of the data were homogenous. If variances were homogeneous, a t Test or a parametric, one-way analysis of variance (ANOVA), was used to determine if significant differences existed between reference organisms and organisms exposed to dredged material. If variances were not homogeneous as judged by Cochran's test, the data were transformed (natural logarithm of X + 1), and the transformed data were evaluated for homogeneity of variances by Cochran's technique. Transformed data exhibiting homogenous variances were analyzed for significant differences by a parametric, one-way ANOVA. All values at the detection limit were treated in statistical analyses by using the detection limit as if it were the datum. In all statistical tests, the symbols "*" and "ns" are used to denote significant and nonsignificant differences, respectively.

RESULTS

Bioassay Studies

Data produced by solid phase bioassays with grass shrimp, hard clams, and sandworms are presented in Tables 1, B1, and B2 (Appendix B). Mean survival of organisms exposed for 10 days to dredged material was 98.0 percent (grass shrimp), 100.0 percent (hard clams), and 94.0 percent (sandworms).

Analysis of total (combined) survival data for the three species exposed for ten days to control sediment, reference (disposal-site) sediment, and the solid phase of the dredged material is presented in Tables 1 to 3. Mean survival of control organisms was greater than 90 percent, thus allowing evaluation of data from tests with reference sediment and dredged material. These data indicate that total survival of organisms exposed to the solid phase of the dredged material was not significantly lower (α=0.05) than total survival of organisms exposed to reference sediment. Thus, it is concluded that, with regard to its toxilogical effects, the solid phase of the dredged material is ecologically acceptable for discharge to the proposed disposal site.[a]

Bioaccumulation Studies

Concentrations of Hg, Cd, DDT, PCBs, and aliphatic and aromatic petroleum hydrocarbons in grass shrimp (Palaemonetes pugio), hard clam (Mercenaria mercenaria), and sandworms (Nereis virens) that survived 10-day exposure to refeence (disposal-site) sediment and solid phase of dredged material are presented in Table 3. Mean concentrations of the DDT family in tissues in grass shrimp, hard clams, and sandworms that survived ten-day exposure to the solid phase of dredged material were always less than the analytical detection limit of 0.04 ug/g wet wt. (Table 9). Mean concentrations of Cd (Table 8) in organisms exposed to dredged material were also below mean concentrations in reference organisms.

Mean concentrations of Hg, PCBs and aromatic petroleum hydrocarbons in hard clams and PCBs and aromatic and aliphatic petroleum hydrocarbons in sandworms (Tables 7, 10-12) were also below those in reference organisms. In the remaining samples analyzed for Cd, Hg, PCBs, and aliphatic and aromatic petroleum hydrocarbons, tissue concentrations in organisms exposed to dredged material were usually not significantly elevated (α=0.05) above concentrations observed in reference organisms. However, significant (α=0.05) bioaccumulation did occur in the case of PCBs in grass shrimp exposed to the dredged material from Smith Cove.

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[a]Paragraph 37, page F17, Appendix F of the EPA and COE manual for dredged material (U.S. EPA and U.S. Army COE, 1977) states that a solid phase has "real potential for causing environmentally unacceptable impacts on benthic organisms [only if] the difference in mean survival between animals in the control and test sediments is statistically significant and greater than 10 percent."

Table 1--Results of Solid Phase bioassay with grass shrimp (Palaemonetes pugio), hard clams (Mercenaria mercenaria), and sandworms (Nereis virens) exposed for ten days to control sediment, reference (disposal-site) sediment, and solid phase of dredged material

Number of Survirors[a]

TREATMENT	CONTROL				DREDGE				REFERENCE			
Replicate	Grass Shrimp	Hard Clams	Sand Worms	Total	Grass Shrimp	Hard Clams	Sand Worms	Total	Grass Shrimp	Hard Clams	Sand Worms	Total
1	39	20	20	79	40	20	15	75	39	20	19	78
2	38	20	20	78	39	20	20	79	32	20	20	72
3	39	20	20	79	39	20	20	79	40	20	20	80
4	--	--	--	--	40	20	20	80	37	19	19	75
5	--	--	--	--	38	20	19	77	40	20	19	79
Mean	38.6	20	20	78.6	39.2	20	18.8	78	37.6	19.8	19.4	76.8
-(%)	(96.5)	(100)	(100)	(98.25)	(98)	(100)	(94)	(97.5)	(94)	(99)	(97)	(96)

[a] Forty (40) grass shrimp, twenty (20) hard clams, and 20 sandworms were initially exposed to each replicate of a treatment. Thus, a total of 80 animals was employed in each aquarium.

Table 2.--Analysis of total (combined) survival data for grass shrimp (*Palaemonetes pugio*), hard clams, (*Mercenaria mercenaria*), and sandworms (*Nereis virens*) exposed for ten-days to reference (disposal site) sediment and solid phase of dredged material.

Step 1. Total Survival Data (From Table 1)

Total Number of Survivors

Replicate	Reference Sediment	Dredge Sediment
1	78	75
2	72	79
3	80	79
4	75	80
5	79	77
Sum of Data $= \Sigma x =$	384	390
Mean $\bar{x}$ =	76.8	78
Sum of Squares $SS = \Sigma (x-\bar{x})^2$	42.8	24.0
Variance S^2 =	10.7	6.0

Step 2. Cochran's Test for Homogeneity of Variances of Total Survial Data

Number of Survivors

	Mean ($\bar{x}$)	Variances (S^2)
References (Disposal-Site) Sediment	76.8	10.7
Dredge Material	78.0	6.0

$$C_{(cal)} = \frac{S^2 \text{ (max)}}{\Sigma S^2} = \frac{10.7}{16.7} = 0.6407 \text{ ns},$$

As compared to $C_{(tab)} = 0.9057$ for $x=0.05$, $k=2$, $v=4$

Step 3. t Test.

$$t = \frac{|\bar{x}_R - \bar{x}_D|}{\sqrt{\dfrac{S^2_R + S^2_D}{n}}} = \frac{1.2}{\sqrt{\dfrac{16.7}{5}}} = \frac{1.20}{1.82} = 0.6593 \text{ ns},$$

as compared to $t_{(tab)} = 1.8595$ for $x = 0.05$, df=8

Table 3 Concentration of Hg, Cd, DDT, PCBs, and aliphatic and aromatic petroleum hydrocarbons in grass shrimp (Palaemonetes pugio), hard clams (Mercenaria mercenaria) and sand worms (Nereis virens) that survived 10-day exposure to reference (disposal-site) sediment and solid phase of dredged material.

		Concentration (ug/g wet wt.)				Petroleum Hydrocarbons	
Grass Shrimp	Rep.	Hg	Cd	DDT	PCBs	Aliphatic	Aromatic
Reference Sediment	1	0.034	0.278	<0.04	<0.04	14.00	6.90
	2	0.029	0.460	<0.04	0.06	12.00	3.80
	3	0.060	0.102	<0.04	<0.04	7.00	1.60
	4	0.054	0.253	<0.04	0.05	14.00	2.50
	5	0.017	0.230	<0.04	0.08	34.00	26.00
Dredged Material	1	0.018	0.124	<0.04	0.08	2.00	0.48
	2	0.016	0.218	<0.04	0.09	14.00	12.00
	3	0.017	0.151	<0.04	0.07	83.00	31.00
	4	0.026	0.195	<0.04	0.12	61.00	36.00
	5	0.190	0.207	<0.04	0.09	16.00	20.00
Blank (average)		<0.005	0.021	<0.04	<0.04	13.00	4.00
Hard Clams							
Reference	1	0.011	0.169	<0.04	<0.04	2.10	0.10
	2	0.024	0.194	<0.04	0.20	3.90	1.70
	3	0.017	0.227	<0.04	0.04	3.30	2.90
	4	0.028	0.074	<0.04	0.04	3.40	10.00
	5	0.045	0.249	<0.04	<0.04	0.47	<0.10
Dredged Material	1	0.013	0.098	<0.04	<0.04	<0.10	<0.10
	2	0.009	0.197	<0.04	0.09	6.20	2.70
	3	0.017	0.192	<0.04	0.10	7.90	2.60
	4	0.010	0.100	<0.04	0.05	9.50	3.40
	5	0.016	0.184	<0.04	0.04	11.00	<0.10
Blank (average)		<0.005	0.016	<0.04	<0.04	3.30	1.00
Sandworms							
Reference	1	0.016	0.172	<0.04	0.10	9.10	2.40
	2	0.023	0.116	<0.04	0.06	8.80	2.20
	3	0.017	0.150	<0.04	0.08	7.70	2.10
	4	0.024	0.164	<0.04	0.04	33.00	4.50
	5	0.018	0.137	<0.04	<0.04	6.90	0.31
Dredged Material	1	0.018	0.180	<0.04	<0.04	0.95	<0.10
	2	0.014	0.161	<0.04	<0.04	13.00	1.60
	3	0.015	0.127	<0.04	<0.04	15.00	1.90
	4	0.041	0.104	<0.04	0.04	16.00	0.11
	5	0.016	0.131	<0.04	0.05	17.00	3.30
Blank (average)		<0.005	0.019	<0.04	<0.04	3.30	1.00

Table 4 Bioaccumulation Data of Control Tissue Samples. Concentrations of Hg, Cd DDT, PCBs, and aliphatic and aromatic petroleum hydrocarbons in grass shrimp (*Palaemonetes pugio*), hard clams (*Mercenaria mercenaria*), and sandworms (*Nereis virens*) exposed to control sediment for 10 days.

		Concentration (µg/g wet wt.)				Petroleum Hydrocarbons	
	Rep.	Hg	Cd	DDT	PCBs	Aliphatic	Aromatic
Organism							
Grass Shrimp	1	0.0320	0.05	<0.04	<0.04	2.1	0.6
	2	0.0160	0.22	<0.04	<0.04	<0.1	<0.1
	3	0.0140	0.25	<0.04	<0.04	<0.1	<0.1
Blanks (Average)		<0.005	0.02	<0.04	<0.04		
Hard Clams	1	0.0035	0.15	<0.04	<0.04	1.2	0.7
	2	0.0065	0.35	<0.04	<0.04	1.5	0.8
	3	0.0078	0.28	<0.04	<0.04	<0.1	<0.1
Blanks (Average)		<0.005	0.02	<0.04	<0.04		
Sandworms	1	0.0061	0.06	<0.04	<0.04	2.7	0.7
	2	0.0067	0.01	<0.04	<0.04	<0.1	<0.1
	3	0.0078	0.05	<0.04	0.06	<0.1	<0.1
Blanks (Average)		<0.005	0.01	<0.04	<0.04	<0.1	<0.1

Table 5--Concentrations of Hg, Cd, DDT, PCBs, and aliphatic and aromatic petroluen hydrocarbons in subsamples of grass shrimp (Palaemonetes pugio), hard clams (Mercenaria mercenaria), and sandworms (Nereis virens) employed in the bioassays (Pre-Test Tissue).

	Rep.	Concentration (µg/g wet wt.) Hg	Cd	DDT	PCBs	Petroleum Hydrocarbons Aliphatic	Aromatic
Organism							
Grass Shrimp	1	0.010	0.13	<0.04	<0.04	1.3	1.0
	2	0.008	0.31	<0.04	<0.04	1.8	0.8
	3	0.021	0.22	<0.04	<0.04	2.7	1.2
Blanks (average)		<0.005	0.02	<0.04	<0.04	<0.1	<0.1
Hard Clams	1	0.019	0.33	<0.04	<0.04	3.3	1.7
	2	0.009	0.30	<0.04	<0.04	2.4	2.1
	3	0.013	0.16	<0.04	<0.04	7.8	0.9
Blanks (average)		<0.005	0.02	<0.04	<0.04	<0.1	<0.1
Sandworms	1	0.007	0.11	<0.04	<0.04	0.9	1.3
	2	0.020	0.08	<0.04	<0.04	1.7	0.5
	3	0.012	0.20	<0.04	<0.04	1.0	2.1
Blanks (average)		<0.005	0.02	<0.04	<0.04	<0.1	<0.1

Table 6--Quality-Control information pertaining to solid-phase bioaccumulation studies with grass shrimp (<u>Palaemonetes pugio</u>), hard clams (<u>Mercenaria mercenaria</u>), and sandworms (<u>Nereis virens</u>).

Precision data (concentration of chemical constituents in triplicate subsamples) µg/g wet wt.	Chemical constituent	Organism analyzed		
		Grass Shrimp	Hard Clams	Sandworms
A. Control Sediment	Cadmium	0.05, 0.22, 0.25	0.15, 0.35, 0.28	0.06, 0.01, 0.05
	Mercury	0.032, 0.016, 0.014	0.0035, 0.0085, 0.0078	0.0061, 0.0067, 0.0078
	PCBs	<0.04, <0.04, <0.04	<0.04, <0.04, <0.04	<0.04, <0.04, <0.06
	DDT	<0.04, <0.04, <0.04	<0.04, <0.04, <0.04	<0.04, <0.04, <0.04
	Petroleum hydrocarbons Aliphatic Fraction	2.1, <0.1, <0.1	1.2, 1.5, <0.1	2.7, <0.1, <0.1
	Petroleum hydrocarbons Aromatic Fraction	0.6, <0.1, <0.1	0.7, 0.8, <0.1	0.7, <0.1, <0.1
B. Pretest Tissue	Cadmium	0.13, 0.31, 0.22	0.33, 0.30, 0.16	0.11, 0.08, 0.20
	Mercury	0.01, 0.008, 0.021	0.018, 0.009, 0.013	0.007, 0.020, 0.012
	PCBs	<0.04, <0.04, <0.04	<0.04, <0.04, <0.04	<0.04, <0.04, <0.04
	DDT	0.04, <0.04, <0.04	<0.04, <0.04, <0.04	<0.04, <0.04, <0.04
	Petroleum hydrocarbon Aliphatic Fraction	1.3, 1.8, 2.7	3.3, 2.4, 1.8	0.9, 1.7, 1.0
	Petroleum hydrocarbons Aromatic Fraction	1.0, 0.8, 1.2	1.7, 2.1, 0.9	1.3, 0.5, 2.1

Table 7—Analyses of Mercury (Hg) in tissues of grass shrimp (*Palaemonetes pugio*), hard clams (*Mercenaria mercenaria*), and sandworms (*Nereis virens*) that survived ten-day exposure to reference (disposal-site) sediment and solid phase of dredged material.

Organism	Analysis
Grass shrimp	Step 1. Concentrations of Metal in Tissues

Replicate (r)	Treatment (t):	Concentration (µg/g wet weight) Reference (Disposal-Site)	Dredged Material
1		0.034	0.018
2		0.029	0.016
3		0.060	0.017
4		0.054	0.026
5		0.017	0.190
	Mean ($\bar{x}$):	0.039	0.053

Step 2. Cochran's Test of Homogeneity of Variances of Transformed Data

Treatment (t)	Variance (S^2)
Reference (disposal-site) Sediment	0.000529652
Dredged Material	0.004813455

$$C_{(cal)} = \frac{S^2_{(max)}}{\Sigma S^2} = \frac{0.004813455}{0.005343107} = 0.9008 \text{ ns},$$

as compared to:

$$C_{(tab)} = 0.9057 \text{ for } \alpha = 0.05,\ k = 2, \text{ and } V = 4$$

Step 3. Parametric One-Way Analysis of Variance (ANOVA) of Data

Source of Variation	df	Sum of Squares	Mean Square	$F_{(cal)}$
Treatment	t-1=1	0.000597650	0.000597650	0.2237 ns,
Error	t(r-1)=8	0.021372434	0.002671554	
Total	tr-1=9	0.21970084		

as compared to: $F_{(tab)}$ =

5.32 for α = 0.05 (1,8)

Table 7 (continued)

Organism	Analysis	
Hard Clams	Step 1. Concentrations of Metal in Tissues	
	Concentration (μg/g wet weight)	
Replicate (r) / Treatment (t):	Reference (Disposal-Site)	Dredged Material
1	0.011	0.013
2	0.024	0.009
3	0.017	0.017
4	0.028	0.010
5	0.045	0.016
Mean ($\bar{X}$):	0.025	0.013

- - - - Further analysis Not Warranted - - -
($\bar{x}$ for dredged material less than or equal to $\bar{x}$ for reference sediment).

Table 7 (continued)

Organism	Analysis
Sandworms	Step 1. Concentrations of in Metal Tissues

Replicate (r)	Treatment (t):	Concentration (µg/g wet weight) Reference (Disposal-Site)	Dredged Material
1		0.016	0.018
2		0.023	0.014
3		0.017	0.015
4		0.024	0.041
5		0.018	0.016
	Mean ($\overline{x}$):	0.019	0.021

Step 2. Cochran's Test for Homogeneity of Variances of Transformed Data

Treatment (t)	Variance (S^2)
Reference (disposal-site) Sediment	0.0000127800
Dredged Material	0.000122714

$$C_{(cal)} = \frac{S^2(max)}{\Sigma S^2} = \frac{0.0000122714}{0.000135494} = 0.90567 \text{ ns,}$$

as compared to:

$C_{(tab)} = 0.9057$ for $\alpha = 0.05$, k=2, and V=4

Step 3. Parametric One-Way Analysis of Variance (ANOVA) of Data

Source of Variation	df		Sum of Squares	Mean Square	F(cal.)
Treatment	t-1=5		0.000003203	0.000003203	0.0473 ns,
Error	t(r-1)=8	20	0.000541979	0.000067747	
Total	tr-1=9	25	0.000545182		

as compared to: $F_{(tab)} =$

5.32 for $\alpha = 0.05$ (1,8)

Table 8--Analyses of Cadmium in tissue of grass shrimp (*Palaemonetes pugio*), hard clams (*Mercenaria mercenaria*), and sand worms (*Nereis virens*) that survived ten-day exposure to reference (disposal-site) sediment and solid phase of dredged material.

Organism		Analysis	
Grass shrimp		Step 1. Concentrations of Metal in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		0.278	0.124
2		0.460	0.218
3		0.102	0.151
4		0.253	0.195
5		0.230	0.207
	Mean ($\overline{x}$):	0.265	0.179

- - - - Further Analysis Not Warranted - - - -
($\overline{x}$ for dredged material less than or equal to $\overline{x}$ for reference sediment).

Hard Clams		Step 1. Concentrations of Metal in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		0.169	0.098
2		0.194	0.197
3		0.227	0.192
4		0.074	0.100
5		0.249	0.184
	Mean ($\overline{x}$):	0.183	0.154

- - - - Further Analysis Not Warranted - - -
($\overline{x}$ for dredged material less than or equal to $\overline{x}$ for reference sediment).

Sandworms		Step 1. Concentrations of Metal in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		0.172	0.180
2		0.116	0.161
3		0.150	0.127
4		0.164	0.104
5		0.137	0.131
	Mean ($\overline{x}$):	0.148	0.141

- - - - Further Analysis Not Warranted - - - -
($\overline{x}$ for dredged material less than or equal to $\overline{x}$ for refeence sediment).

Table 9--Analyses of DDT in tissue of grass shrimp (*Palaemonetes pugio*), hard clams (*Mercenaria mercenaria*), and sandworms (*Nereis virens*) that survived ten-day exposure to reference (disposal-site) sediment and solid phase of dredged material.

Organism		Analysis	
Grass shrimp		Step 1. Concentrations in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		<0.04	<0.04
2		<0.04	<0.04
3		<0.04	<0.04
4		<0.04	<0.04
5		<0.04	<0.04
	Mean (x):	0.04	0.04

- - - - Further Analysis Not Warranted - - - -
($\bar{x}$ for dredged material less than or equal to $\bar{x}$ for reference sediment).

Hard Clams		Step 1. Concentrations in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		<0.04	<0.04
2		<0.04	<0.04
3		<0.04	<0.04
4		<0.04	<0.04
5		<0.04	<0.04
	Mean ($\bar{x}$):	0.04	0.04

- - - - Further Analysis Not Warranted - - - -
($\bar{x}$ for dredged material less than or equal to $\bar{x}$ for reference sediment).

Sandworms		Step 1. Concentrations in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		<0.04	<0.04
2		<0.04	<0.04
3		<0.04	<0.04
4		<0.04	<0.04
5		<0.04	<0.04
	Mean ($\bar{x}$):	0.04	0.04

- - - - Further Analysis Not Warranted - - - -
($\bar{x}$ for dredged material less than or equal to $\bar{x}$ for reference sediment).

Table 10--Analyses of PCBs in tissues of grass shrimp (*Palaemonetes pugio*), hard clams (*Mercenaria mercenaria*), and sandworms (*Nereis virens*) that survived ten-day exposure to reference (disposal-site) sediment and solid phase of dredged material.

Organism	Analysis
Grass shrimp	Step 1. Concentrations in Tissues

Replicate (r)	Treatment (t):	Concentration (µg/g wet weight) Reference (Disposal-Site)	Dredged Material
1		<0.04	0.08
2		0.06	0.09
3		<0.04	0.07
4		0.05	0.12
5		0.08	0.09
	Mean ($\bar{x}$):	0.054	0.090

Step 2. Cochran's Test for Homogeneity of Variances of Data

Treatment (t)	Variances (S^2)
Reference (disposal-site) Sediment	0.000409
Dredged Material	0.000350

$$C_{(cal)} = \frac{S_2^2(max)}{\Sigma S^2} = \frac{0.000409}{0.000759} = 0.5389 \text{ ns,}$$

as compared to:

$C_{(tab)} = 0.9057$ for $\alpha=0.05$, $k=2$, and $V=4$

Step 3. Parametric One-Way Analysis of Variance (ANOVA) of Data

Source of Variation	df	Sum of Squares	Mean Square	F (cal.)
Treatment	t-1=1	0.003240	0.003240	
Error	t(r-1)=8	0.003036	0.000379	8.54*
Total	tr-1=9	0.006276		

as compared to: $F_{(tab)} = 5.32$ for $\alpha = 0.05$ (1,8)

Table 10 (continued)

Organism	Analysis		
Hard Clams	Step 1. Concentrations in Tissues		
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		<0.04	<0.04
2		0.20	0.09
3		0.04	0.10
4		0.04	0.05
5		<0.04	0.04
	Mean ($\overline{x}$):	0.072	0.064

- - - - Further Analysis Not Warranted - - - -
($\overline{x}$ for dredged material less than or equal to $\overline{x}$ for reference sediment).

Sandworms	Step 1. Concentrations in Tissues		
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		0.10	<0.04
2		0.06	<0.04
3		0.08	<0.04
4		0.04	0.04
5		<0.04	0.05
	Mean ($\overline{x}$):	0.064	0.042

- - - - Further Analysis Not Warranted - - - -
($\overline{x}$ for dredged material less than or equal to $\overline{x}$ for reference sediment).

Table 11--Analyses of aliphatic fraction of petroleum hydrocarbons in tissues of grass shrimp (*Palaemonetes pugio*), hard clams (*Mercenaria mercenaria*), and sandworms (*Nereis virens*) that survived ten-day exposure to reference (disposal-site) sediment and solid phase of dredged material.

Organism	Analysis
Grass shrimp	Step 1. Concentrations in Tissues

Replicate (r)	Treatment (t):	Concentration (µg/g wet weight) Reference (Disposal-Site)	Dredged Material
1		14.0	2.0
2		12.0	14.0
3		7.0	83.0
4		14.0	61.0
5		34.0	16.0
	Mean ($\overline{x}$):	16.2	35.2

Step 2. Cochran's Test of Homogeneity of Variances of Transformed Data

Treatment (t)	Variance (S^2)
Reference (disposal-site) Sediment	0.2831
Dredged Material	0.4611

$$C(cal) = \frac{S^2(max)}{\sum S^2} = \frac{0.4611}{0.7442} = 0.6196 \text{ ns},$$

as compared to:

$C_{(tab)} = 0.9057$ for $\alpha = 0.05$, $k=2$, and $V=4$

Step 3. Parametric One-Way Analysis of Variance (ANOVA) of Data

Source of Variation	df	Sum of Squares	Mean Square	F(cal.)
Treatment	t-1=1	0.25027	0.25027	0.6726 ns,
Error	t(r-1)=8	2.97668	0.37208	
Total	tr-1=9	3.22695		

as compared to: $F_{(tab)} = 5.32$ for $\alpha = 0.05$ (1,8)

Table 11 (Continued)

Organism		Analysis	
Hard Clams		Step 1. Concentrations in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		2.10	<0.10
2		3.90	6.20
3		3.30	7.90
4		3.40	9.50
5		0.47	11.00
	Mean ($\bar{x}$):	2.63	6.94

Step 2. Cochran's Test for Homogeneity of Variances of Data

Treatment (t)	Variance (S^2)
Reference (disposal-site) Sediment	1.90028
Dredged Material	17.82300

$$C(cal) = \frac{S^2(max)}{\Sigma S^2} = \frac{17.82300}{19.72328} = 0.9036 \text{ ns,}$$

as compared to:

$C_{(tab)} = 0.9057$ for $\alpha = 0.05$, $k=2$, and $V=4$

Step 3. Parametric One-Way Analysis of Variance (ANOVA) of Data

Source of Variation	df	Sum of Squares	Mean Square	F(cal)
Treatment	t-1=1	46.35409	46.35409	4.70 ns,
Error	t(r-1)=8	78.89312	9.86164	
Total	tr-1=9	125.24721		

as compared to: $F_{(tab)} = 5.32$ for $\alpha = 0.05$ (1,8)

Table 11 (continued)

Organism		Analysis	
Sandworms		Step 1. Concentrations in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		9.1	0.95
2		8.8	13.00
3		7.7	15.00
4		33.0	16.00
5		6.9	17.00
	Mean ($\bar{x}$):	13.1	12.39

- - - - Further Analysis Not Warranted - - - -
($\bar{x}$ for dredged material less than or equal to $\bar{x}$ for reference sediment).

Table 12--Analyses of aromatic fraction of petroleum hydrocarbons in tissues of grass shrimp (*Palaemonetes pugio*), hard clams (*Mercenaria mercenaria*), and sandworms (*Nereis virens*) that survived ten-day exposure to reference (disposal-site) sediment and solid phase of dredged material.

Organism	Analysis
Grass shrimp	Step 1. Concentrations in Tissues

Replicate (r)	Treatment (t):	Concentration (µg/g wet weight) Reference (Disposal-Site)	Dredged Material
1		6.9	0.48
2		3.8	12.00
3		1.6	31.00
4		2.5	36.00
5		26.0	20.00
	Mean ($\bar{x}$):	8.16	19.896

Step 2. Cochran's Test for Homogeneity of Variances of Data

Treatment (t)	Variances (S^2)
Reference (disposal-site) Sediment	103.48
Dredged Material	205.49

$$C_{(cal)} = \frac{S^2_{(max)}}{\Sigma S^2} = \frac{205.49}{308.98} = 0.6650 \text{ ns},$$

as compared to:

$$C_{(tab)} = 0.9057 \text{ for } \alpha=0.05,\ k=2, \text{ and } V=4$$

Step 3. Parametric One-Way Analysis of Variance (Anova) of Data

Source of Variation	df	Sum of Squares	Mean Square	F(cal.)
Treatment	t-1=1	344.33	344.33	
Error	t(r-1)=8	1235.91	154.49	2.23 ns,
Total	tr-1=9	1580.24		

as compared to: $F_{(tab)} = 5.32$ for $\alpha = 0.05$ (1,8)

Table 12 (continued)

Organism		Analysis	
Hard Clams		Step 1. Concentrations in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		0.10	<0.10
2		1.70	2.70
3		2.90	2.60
4		10.00	3.40
5		<0.10	<0.10
	Mean ($\bar{x}$):	2.96	1.78

- - - - Further Analysis Not Warranted - - - -
($\bar{x}$ for dredged material less than or equal to $\bar{x}$ for reference sediment).

Organism		Analysis	
Sandworms		Step 1. Concentrations in Tissues	
	Treatment (t):	Concentration (µg/g wet weight)	
Replicate (r)		Reference (Disposal-Site)	Dredged Material
1		2.40	<0.10
2		2.20	1.60
3		2.10	1.90
4		4.50	0.11
5		0.31	3.30
	Mean ($\bar{x}$):	2.30	1.40

- - - - Further Analysis Not Warranted - - - -
($\bar{x}$ for dredged material less than or equal to $\bar{x}$ for reference sediment).

DISCUSSION

The test organisms employed in the ecological assessment of proposed dredged material from Smith Cove, are considered (U.S. EPA and U.S. Army COE, 1977) to be sensitive to dredged material and appropriate for testing with the material. To be considered appropriate for testing with dredged material, organisms, in addition to being sensitive to the material, must be reliable test organisms (commonly used in bioassays) and representative of broad taxonomic or trophic (feeding) groups (U.S. EPA, 1977). In the case of organisms used in solid phase tests, representation in according to feeding characteristics, i.e., a filter-feeder, deposit feeder, and burrowing species must be evaluated (U.S. EPA, 1977). Consequently, the results of this ecological assesment are applicable to a wide variety of sensitive benthic organisms indigenous to the proposed disposal site.

The bioassay (toxicity-related) studies performed in this assessment indicate that the proposed discharge of dredged material from Smith Cove, Gloucester, Massachusetts would be ecologically acceptable according to the criteria established in the ocean dumping regulations (U.S. EPA, 1977). In addition, most of the ~~the~~ bioaccumulation tests performed during the assessment indicate no potential for xenobiotic constituents of the material to accumulate in the human food chain.[b] There was some indication of accumulation potential for PCBs in grass shrimp exposed to the dredged material.

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[b]Paragraph 25, page G11, Appendix G of the EPA and COE manual for dredged material (U.S. PEA and U.S. Army COE, 1977) states that there is "no indication of potential bioaccumulation from [the solid phase of] the dredged material [if there are] no statistical differences between tissue concentration in reference substrate controls and the dredged material."

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Appendix A — Laboratory Procedures for Preparing Dredged Material Reference and Control Sediment and Conducting Bioassays

1. Samples were delivered to Sea Plantations Aquaculture Facility in Salem, Massachusetts by Forest Knowles of the Army Corps of Engineers on September 15, 1983. Upon receipt, samples were logged and placed in 2-4°C storage for no more than 12 days after the sampling date before use.

2. Reference sediment was prepared for use in the acclimation period and bioassay by wet seiving through 1 mm^2 mesh fiberglass screen using no more than five gallons of salt water. Live organisms retained on the fiberglass mesh were discarded. The sample was allowed to settle undisturbed for six hours. Control sediment was prepared in an identical manner.

3. Clean glass 40 liter aquaria were half filled with saltwater. Aquaria designated as reference sediment, control sediment, or dredged material tanks were randomly selected. 3.5 liters of reference sediment was added to attain a 30 centimeter depth in aquaria designated for reference sediment and dredged material testing (five aquaria each). The same quantity of seived control sediment was similarly added to the three aquaria functioning as control samples.

   Sediment added to the aquarium was allowed to settle for one hour, after which time water flow and aeration were initiated. Water exchange was by the flow through method. A flow rate of 250 ml/minute was maintained in each tank throughout the bioassay. Saltwater was pumped daily from Salem Harbor into the aquaculture facility saltwater holding tanks. All water entering the bioassay system passed through both a biological sand filter and a diatomaceous earth filter. The unused seived reference and control sediment was returned to 2-4°C storage for later use.

4. Test organisms were not added to the aquarium until two hours following the initiation of the flow through water exchange. This allowed the water to clear of excess suspended sediment and thus decreased the potential stress on assay organisms.

5. Forty grass shrimp (Palaemonetes pugio), twenty hard clams (Mercenaria mercenaria) and twenty sandworms (Nereis virens) were added to each aquarium. Healthy specimens were first randomly counted into plastic containers of seawater, and then placed into appropriate aquaria. Organisms were allowed to acclimate in the aquaria for 48 hours. During this time samples of each species were randomly chosen as pretest tissue samples. These samples were frozen immediatley for future analyses in the bioaccumulation study.

6. During the acclimiation period aquaria were observed for the presence of dead specimens, and, if present, were removed and replaced with healthy specimens. Mortalities never exceeded 10 per cent of the seeded specimens.

7. After the 48 hour acclimation period hard clams (Mercenaria mercenaria) and sandworms (Nereis virens) were established in the sediment. The dredged material was seived as described previously. Reference sediment, control

sediment, and dredged material were brought to a temperature of approximately that of the seawater in the aquaria. Water flow was turned off, and a seawater volume slightly greater than the material to be introduced was removed from each aquaria. Dredged material was added in quantities sufficient to produce a 15 mm layer on top of the 30 mm reference sediment layer in the test aquaria. An additional 15 mm layer of reference sediment was place on the reference aquaria. Similarly, a quantity of control sediment was added to produce a 15-mm layer over the sediment in the control aquaria. After allowing 1 hour for settling, the waterflow was turned on again.

8. The bioassay continued for 10 days, during which daily records were kept of obvious mortalities, levels of salinity, temperature, pH, and dissolved oxygen content of aquaria water were recorded. (Table B1, B2)

   During the bioassay the temperature ranged between the designated limits of $20 \pm 1^{\circ}C$, salinity remained constant at 30 ppt, and dissolved oxygen was always above 5 ppm. Recorded pH valves ranged between 7.7 and 8.0.

9. After 10 days, the flow of water was turned off in each aquaria as the animals were removed. Grass shrimp (Palaemonetes pugio) were netted and counted into plastic containers. The water was then drained from the aquaria. Hard clams (Mercenaria mercenaria) and sandworms (Nereis virens) were then gently removed by hand and the number of survivors recorded. The remaining sediment was carefully examined for organisms. Animals were considered alive if they showed a response to gentle probing of a sensitive part.

10. All surviving organisms from each aquarium (replicate) were placed in an aquarium containing clean, sediment free water and allowed to void their digestive systems. A mesh divider was used to separate the sandworms from the grass shrimp in order to prevent predation by the grass shrimp. Organisms were maintained in uncontaminated media for a period of two days. During this time, fecal material was removed from the aquaria. At the end of the two-day period, all samples of the organisms were removed from the aquaria. All organisms were placed into polyethylene WHIRL PAK bags, and frozen for later analyses. The shells of hard clams were removed prior to freezing.

APPENDIX B

UNANALYZED BIOASSAY-RELATED DATA

able B1. Bioassay Data Sheet, Daily dissolved Oxygen, pH, Salinity, Temperature, and
ive Organism counts of control, reference sediment, and dredged material aquaria.

Date 9/23/84 Time 7 pm
Test Organisms Mercenaria mercenaria
Nereis virens
Palaemonetes pugio

Test Container Number		Number of Live Organisms Day 0	1	2	3	4	5	Dissolved Oxygen (mg/l) 0	1	2	3	4	5	pH 0	1	2	3	4	5	Salinity 0	1	2	3	4	5	Temperature 0	1	2	3	4	5
ontrol C ediment	1	80	80	80	80	80	80	6.7	6.9	7.0	7.0	6.9	7.0	7.7	7.8	7.9	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1
	2	80	80	80	80	80	80	6.6	6.9	7.0	7.0	7.1	7.1	7.7	7.8	7.9	7.4	7.7	7.8	30	30	30	30	30	30	19	19	19	19	19	1
	3	80	80	80	80	80	80	6.7	6.8	7.0	6.9	7.1	7.0	7.7	7.8	7.8	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1
redge aterial	1	80	80	80	80	80	80	6.5	6.6	6.8	6.9	6.8	6.8	7.7	7.8	7.9	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1
	2	80	80	80	80	80	80	6.6	6.7	6.7	6.6	6.5	6.6	7.7	7.8	7.9	7.7	7.6	7.9	30	30	30	30	30	30	19	19	19	19	19	1
	3	80	80	80	80	80	80	6.6	6.7	6.8	6.7	6.6	6.6	7.7	7.8	7.9	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1
	4	80	80	80	80	80	80	6.6	6.7	6.7	6.7	6.6	6.5	7.7	7.8	7.8	7.6	7.7	7.8	30	30	30	30	30	30	19	19	19	19	19	1
	5	80	80	80	80	80	80	6.4	6.7	6.6	6.5	6.5	6.6	7.8	7.8	7.8	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1
eference ediment	1	80	80	80	80	80	80	6.8	6.7	6.6	6.5	6.6	6.5	7.7	7.8	7.8	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1
	2	80	80	80	80	80	80	6.5	6.7	6.7	6.6	6.5	6.6	7.7	7.8	7.9	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1
	3	80	80	80	80	80	80	6.6	6.6	6.6	6.7	6.8	6.7	7.7	7.6	7.9	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1
	4	80	80	80	80	80	80	6.5	6.7	6.7	6.8	6.7	6.6	7.7	7.6	7.9	7.8	7.8	8.0	30	30	30	30	30	30	19	19	19	19	19	1
	5	80	80	80	80	80	80	6.5	6.5	6.6	6.5	6.6	6.5	7.7	7.6	7.9	7.7	7.7	7.9	30	30	30	30	30	30	19	19	19	19	19	1

EA-VII2b

TABLE B1 (continued)

Test Container Number		Number of Live Organisms Day 6	7	8	9	10	Dissolved Oxygen (mg/l) 6	7	8	9	10	pH 6	7	8	9	10	Salinity 6	7	8	9	10	Temperature 6	7	8	9	1
Control	1	79	79	79	79	79	7.1	6.9	7.0	7.1	6.9	7.8	7.8	7.9	7.8	7.9	30	30	30	30	30	19	19	19.5	19	1
Sediment	2	80	80	80	79	75	7.0	6.8	7.0	7.1	6.8	7.7	7.7	7.8	7.8	7.7	30	30	30	30	30	19	19	19.5	19	1
	3	79	79	79	79	78	7.1	6.9	7.0	6.8	6.7	7.6	7.7	7.8	7.8	7.9	30	30	30	30	30	19	19	19.5	19	1
Dredge	1	77	77	77	77	75	6.8	6.9	7.1	6.9	6.8	7.8	7.8	7.9	7.8	7.8	30	30	30	30	30	19	19	19.5	19	1
Material	2	79	79	79	79	79	6.9	7.0	6.9	6.9	6.8	7.7	7.7	7.8	7.8	7.8	30	30	30	30	30	19	19	19.5	19	1
	3	79	79	79	79	79	6.8	6.9	6.8	6.8	6.8	7.7	7.7	7.8	7.8	7.8	30	30	30	30	30	19	19	19.5	19	1
	4	79	79	79	79	80	6.8	6.8	6.7	6.8	6.9	7.7	7.6	7.8	7.8	7.8	30	30	30	30	30	19	19	19.5	19	1
	5	80	80	80	80	77	6.7	6.8	6.6	6.8	6.8	7.8	7.7	7.8	7.8	7.8	30	30	30	30	30	19	19	19.5	19	1
Reference	1	80	80	80	80	78	6.8	6.7	6.6	6.7	6.8	7.8	7.8	7.8	7.8	7.8	30	30	30	30	30	19	19	19.5	19	1
Sediment	2	80	80	80	80	72	6.7	6.6	6.5	6.6	6.7	7.8	7.7	7.9	7.8	7.9	30	30	30	30	30	19	19	19.5	19	1
	3	80	80	80	80	80	6.5	6.6	6.5	6.7	6.6	7.8	7.8	7.9	7.9	7.9	30	30	30	30	30	19	19	19.5	19	1
	4	80	80	80	80	75	6.4	6.6	6.5	6.7	6.8	7.8	7.8	7.9	7.9	7.9	30	30	30	30	30	19	19	19.5	19	1
	5	80	80	80	80	79	6.7	6.6	6.5	6.6	6.7	7.8	7.8	7.9	7.9	7.9	30	30	30	30	30	19	19	19.5	19	1

EA-VII3b

Table B2. Daily counts of live Hard Clams (*Mercenaria mercenaria*) Sandworms (*Nereis virens*) and Grass Shrimp (*Palaemonetes pugio*) in aquaria containing dredged material, reference sediment, or control sediment

Begin: Date 9/23/83 Time 7pm
End: Date 10/3/83 Time 7 pm
Test Organisms *Mercenaria mercenaria*
Nereis virens
Palaemonetes pugio

	Test Container Number	Number of *Mercenaria mercenaria*						Number of *Nereis virens*						Number of *Palaemonetes pugio*					
		0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
Control Sediment	1	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	39	39
	2	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
	3	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
Dredge Material	1	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
	2	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	39	39	39
	3	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	39
	4	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
	5	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
Reference Sediment	1	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
	2	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
	3	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
	4	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40
	5	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40

Table B2 (continued)

	Test Container Number	Number of Live *Mercenaria mercenaria* Day 6	7	8	9	10	Number of Live *Nereis virens* 6	7	8	9	10	Number of Live *Palaemonetes pugio* 6	7	8	9	10
ontrol ediment	1	20	20	20	20	20	20	20	20	20	20	39	39	39	39	39
	2	20	20	20	20	20	20	20	20	20	20	40	40	40	40	38
	3	20	20	20	20	20	20	20	20	20	20	40	40	40	40	39
redge aterial	1	20	20	20	20	20	20	20	20	19	15	40	40	40	40	40
	2	20	20	20	20	20	20	20	20	20	20	39	39	39	39	39
	3	20	20	20	20	20	20	20	20	20	20	39	39	39	39	39
	4	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40
	5	20	20	20	20	20	20	20	20	20	19	40	40	40	40	38
eference ediment	1	20	20	20	20	20	20	20	20	20	19	40	40	40	40	39
	2	20	20	20	20	20	20	20	20	20	20	40	40	40	40	32
	3	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40
	4	20	20	20	20	19	20	20	20	20	19	40	40	40	40	37
	5	20	20	20	20	20	20	20	20	20	19	40	40	40	40	40

Appendix EA-VIII

Appendix VIII

Dilution Calculations

COPPER - 44.0 ppb = highest replicate concentration
27.5 ppb = ambient concentration

1. Dilution Factor (see EPA/COE, 1977-Appendix H) D = 32
   Volume of water required to dilute to 27.5 ppb (ambient) = Vol.
   Volume of water to be diluted = VW = $40.8m^3$ (size of the clamshell dredge bucket)

I Vol = D X VW
= D(40.8)
= 32 (40.8)
Vol = $1305.6m^3$

II I = % of available mixing zone impacted
(i.e. calculated to be 0.028 ppm)
= vol./82,800 m^3 (MLW volume in Smith Cove)
= 1.6%

III R = Radius of impact (0.028 ppm) zone.
R^2 = Vol./
R = Vol./
R = 20.4 meters

PCB - 0.70 ppb = highest replicate concentration.
0.05 ppb = ambient concentration

1. Dilution Factor (see EPA/COE, 1977 - Appendix H) D = 129
Volume of water required to dilute to 0.05 ppb (ambient) = Vol.
Volume of water to be diluted = VW = $40.8m^3$ (size of the clamshell dredge bucket)

I Vol = D X VW
= D(40.8)
= 129 (40.8)
Vol = $5,263.2m^3$

II I = % of available mixing zone impacted
(i.e. calculated to be 0.051 ppb)
= vol./$82,800m^3$ (MLW volume in Smith Cove)
= 6.4%

III R Radius of impact (0.051 ppb) zone.
R^2 = Vol./
R Vol./
R = 40.9 meters

Appendix IX

Correspondence

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. BOX 1518
CONCORD, NEW HAMPSHIRE 03301

MAR 22 1985

Mr. Joseph Ignazio, Chief
Planning Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Mr. Ignazio:

This Planning Aid Letter is intended to assist your planning efforts on the Smith Cove, Gloucester Harbor Section 107 Navigation Study. It is submitted in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.).

It is our present understanding that the most likely federal navigation project for Smith Cove is an anchorage area located in the southern end on tidelands held by the City of Gloucester. The exact boundaries of the proposed anchorage are as yet, unidentified.

Smith Cove is an embayment within the inner harbor at Gloucester, Massachusetts. It was formed by constructing a causeway on an intertidal bar between East Gloucester and Rocky Neck, an island in Gloucester Harbor. Smith Cove encompasses an area of approximately 22 acres of which about 4-5 acres at the south end are intertidal mud flat. The remaining intertidal areas on the east and west shores have a steeper gradient and are composed of coarse substrate including bedrock outcrops. The subtidal portions are generally 8-17 feet deep at MLW and used extensively as a boat anchorage area. The shoreline is extensively developed with houses, piers, docks, marinas and other commercial structures. Land uses in Smith Cove include private and commercial anchorage and docking facilities and other water dependent and nondependent commercial enterprises.

Living resources in Smith Cove include finfish such as winter flounder, Atlantic silversides, sticklebacks, mummichogs and transient visitors such as Atlantic and blueback herring, mackerel and smelt among others. Larval and juvenile forms of the above referenced species and other euryhaline and marine species can be found in Smith Cove as well as other parts of Gloucester Harbor. The dominant intertidal macrobenthic community includes rockweed, blue mussels, soft-shell clams, sand worms, mud snails, periwinkles and barnacles. Waterfowl such as black ducks and mergansers use Smith Cove as a resting-feeding area during the winter season. Other avifauna include great black-backed and herring gulls, terns and various shorebirds. At the time of our field investigation in mid-March, we found an abundant population of sand or clam worms (Nereis virens), modest numbers of blue mussels and low numbers of soft-shell clams. The presence of large numbers of empty shells suggest that the clam population has recently been depressed by pollution, predation, disease or a combination of factors. In accordance with the Fish and Wildlife Service Mitigation Policy, we consider the intertidal and shallow subtidal habitats to be resource category 2. We were unable to locate any existing site-specific data on the subtidal benthic community in Smith Cove.

The sediment data for Smith Cove indicates that the material is primarily silt or clay and is significantly contaminated with oil and grease, copper, zinc and lead. Our review of the bioassay-bioaccumulation data shows a statistically significant difference between sand worms and grass shrimp exposed to control sediment and Smith Cove "dredge" sediment regarding uptake of aliphatic petroleum hydrocarbons and uptake of PCBs by grass shrimp.

Based on our review of the bioassay-bioaccumulation results, the dredge material from Smith Cove is not ecologically acceptable for open water disposal. During our review of the bioassay-bioaccumulation test, we noted several procedural matters of concern to us. The most profound of which relates to the reference sediment. This material appears to be as, or perhaps more, contaminated than the test or dredge material sediment from Smith Cove. It seems unreasonable to use contaminated material as a control sediment unless the objective is to hedge against statistical differences with the dredge material. The joint EPA-Corps dredge material testing manual clearly and specifically requires an uncontaminated sedimentologically similar sediment (pg. F2, G4) to compare against the dredge material. In addition, the reference manual requires several reference site samples to measure variability of the sediments and effects from previous disposal operations (pg. F2, F3, G3 and G4). We believe the only infallible method to insure that the sedimentologically similar control sediment is in fact, uncontaminated, is to test for the priority pollutants and other known toxic nonconventional pollutants. Contaminants in the control test sediments should be at or below natural background levels for the metals and below detection limits (i.e., nonexistent) for the anthropogenically produced organic compounds.

The test organisms (grass shrimp and hard clams) used in the bioassay-bioaccumulation test are not, in our opinion, the most appropriate species to measure or identify acute or chronic toxicity or uptake of contaminants. Consideration should be given to using a mysid shrimp to replace the grass shrimp and the sheepshead minnow or mummichog would be a preferable test species to the hard clam because of greater sensitivity. The length of the solid phase bioassay-bioaccumulation test needs to be extended to 30 days or longer to allow for the physiological processes of contaminant uptake-depuration to stabilize. The 10-day test period is not sufficiently long to allow for these processes to stabilize. The absence of lab notes recording the physiological and other processes of the test organisms during the test seriously detracts from the value and usefulness of the solid phase bioassay-bioaccumulation test. Information relating to test organism movements, locations within the sediment or aquaria, burrowing or tube building activities, siphoning or pumping activities, feeding or excreting behavior, activity level and general health or well-being are important data to utilize in interpretating test results. It is important to know if the hard clams shut down (i.e., quit pumping) during part or all of the test period and if the grass shrimp stayed up on the sides of the aquaria away from the contaminated sediments. We could not determine if sediment resuspension was employed during the test in an attempt to simulate events occurring at the disposal site. The laboratory procedure of clearing excess suspended sediment from the aquaria prior to adding the test organisms could bias the test because available contaminants would be flushed from the system along with the fine grained sediments. Organisms used as pretest tissue samples were taken randomly from reference and control sediment aquaria during the 48 hour acclimation period. This may have an influence on contaminant levels in the pretest organisms exposed to the reference sediment. Likewise, the test could be biased by acclimating the organisms to the contaminated reference sediment and then exposing them for 10 days to the dredge (Smith Cove) sediment.

These points regarding resuspension, activity of test organisms and the time factor in uptake and depuration results are the subjects of on-going research by EPA, NMFS and others. Results to date indicate that all of these factors are critical in bioassay/bioaccumulation studies.

In summary, we do not believe the dredge materials from Smith Cove are acceptable for open water disposal and recommend that they be physically contained in an upland or other diked disposal area. With regards to dredging an anchorage in Smith Cove, we recommend that any proposed facility not be sited closer than -2 or -3 MLW or 50 feet horizontally from the intertidal habitat. These vertical and horizontal clearances should provide a sufficient safety zone to safeguard these resources from direct physical abuses from the anchorage and its associated uses.

If you should have any questions concerning this letter or desire further coordination relative to the development of acceptable bioassay-bioaccumulation test criteria and procedures, please feel free to contact Mr. Vern Lang at this office (FTS 834-4797).

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Field Office

I. O. Brown
113N

August 21, 1985

Planning Division
Impact Analysis Branch

Mr. Gordon E. Beckett, Supervisor
U.S. Fish and Wildlife Service
Ecological Services
P.O. Box 1518
Concord, New Hampshire 03301

Dear Mr. Beckett:

This letter concerns comments included in your March 22, 1985 Planning Aid Letter regarding the bioassay/bioaccumulation testing for the Smith Cove 107 Navigation Study. Your comments are discussed below by paragraph number as indicated on the attached copy of your letter.

1. You seem to interpret <u>any</u> statistically significant accumulation of <u>any</u> constituent in <u>any</u> test species as a determination of non-acceptability. This is not the methodology used in the past or present by the Corps or EPA, nor is it consistent with the Corps/EPA Implementation Manual. Furthermore, we have not found there to be statistically significant accumulation of aliphatic hydrocarbons in the test shrimp compared to the reference (not control) levels. It should also be noted that aliphatic hydrocarbons are non-toxic to the marine environment.

There seems to be some confusion regarding the use of control vs. reference test results. The control data is analyzed to determine whether any factors, other than the test (area to be dredged) or reference (near, but not influenced by disposal site) sediment, influenced the results. The control organisms are used as a quality assurance check for general test population health and to check laboratory procedures and tank setups. The comparison of that data to that of the test sediment results is procedurally incorrect. Only the reference material results are compared to the test material data for determining whether the potential for significant adverse environmental effects exists.

Our assessment of the PCB level (mean of 0.09 ppm) in the test shrimp is statistically significant compared to the reference results but is not considered to be quantitatively significant and therefore is not felt to signify any potential for unacceptable environmental harm.

Therefore, we disagree with your interpretation that the bioassay/bioaccumulation results show that the sediment is not ecologically acceptable for disposal at the Foul Area.

2. We follow the guidance in the Implementation Manual when establishing and using all reference sites for biological tests. The reference site for the Foul Area is an area near the disposal site and has bottom characteristics similar to the disposal site but is an area that is not affected by dredged material disposal actions which occur within the disposal site. We also follow the Manual (pg. F2 and F3) in determining the number of reference sediment samples and test replicates. Five replicate tank series are always required for the reference analysis. The reference sediment is periodically tested to determine if its chemical status has changed. We have no indication that the reference site has been adversely affected by disposal operations at the Foul Area.

3. We are allowing the use of grass shrimp and hard clams as bioassay test species because they are identified in the Manual as being appropriate benthic marine organisms for performing the tests. Also, they are native throughout the New England region in sufficient quantities and are of adequate size for ease in counting during the ten-day test period and provide sufficient biomass for bioaccumulation analyses. To use a finfish species to replace the hard clam, as you suggested, for the solid phase test does not seem prudent since that would result in eliminating the infaunal bivalve species from the test. This would contradict the Manual's recommended type of animals to be used for this test. To replace the grass shrimp with mysids, as you also suggested, would make it extremely difficult to perform contaminant uptake studies of that species because of their small size.

4. Consideration is being given to extending the solid phase test beyond the "recommended" ten days. Before this can be implemented more information is needed to fully evaluate what additional information could be gained per species per contaminant vs. the practicality and limitations of doing this. Cost is also an important factor. It should be noted, however, that the ten day test period is of that particular duration to show a "potential" for bioaccumulation and is not designed to show what the steady state for contaminant uptake may be.[1]

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[1] Rubenstein, N.I., Lores, E., and Gregory, N. 1983. "Accumulation of PCBs, Mercury, and Cadmium by Nereis virens, Mercenaria mercenaria, and Palaemonetes pugio from Contaminated Harbor Sediments," "Technical Report D-83-4, prepared by U.S. Environmental Protection Agency, Gulf Breeze, Fla., for the U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

5. We agree that information supplied by the laboratory regarding the handling and activity of the test organisms assists in evaluating the test results. The labs are expected to furnish any information regarding unusual behavior that may occur during the testing.

6. The laboratory procedure of adding the test animals two hours following the initiation of test water flow is the method recommended in the Manual. This methodology was designed to best simulate conditions expected to be encountered at the disposal site periphery by the biota following a disposal action.

7. The reference sediment should not be contaminated. Also, pre-test animals should be selected before they are placed in control, reference, or test treatment tanks. This would eliminate any concern regarding change in body burden levels because of contact with differing sediments.

8. We agree. The ongoing Field Verification Program by the Corps and EPA should provide valuable assistance in addressing these and many other important bioassay related questions.

I hope that this information has adequately addressed your concerns with the bioassay/bioaccumulation studies for Smith Cove. Should there by any questions, please feel free to contact Ms. Susan Brown of the Impact Analysis Branch at FTS 839-7138, or Mr. Jim Bajek of the Regulatory Branch at FTS 839-7213

Sincerely,

Joseph L. Ignazio
Chief, Planning Division

Attachment

Ms. Brown✓
Mr. Bajek-Reg Br
Mr. Sparrow-Reg Br
Mr. Bellmer
Mr. Pronovost
IAB Files
Reading Files
Plng Div Files

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. BOX 1518
CONCORD, NEW HAMPSHIRE 03301

Mr. Joseph Ignazio, Chief
Planning Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

JUL 02 1986

Dear Mr. Ignazio:

This responds to your June 19, 1986 request for information on the presence of Federally listed and proposed endangered or threatened species within the impact area of a navigation improvement project at Smith Cove in Gloucester, Massachusetts.

Our review shows that except for occasional transient individuals, no Federally listed or proposed threatened and endangered species under our jurisdiction are known to exist in the project impact area. However, you may wish to contact the Massachusetts Natural Heritage Program for information on state listed species. No Biological Assessment or further consultation is required with us under Section 7 of the Endangered Species Act. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to endangered species under our jurisdiction. It does not address other legislation or our concerns under the Fish and Wildlife Coordination Act.

A list of Federally designated endangered and threatened species in Massachusetts is enclosed for your information. Thank you for your cooperation and please contact us if we can be of further assistance.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Area

Enclosure

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Connecticut River & Atlantic Coastal Waters
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic straggler in Southern New England
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic straggler in Southern New England
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer resident
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident
Turtle, Atlantic ridley*	Lepidochelys kempii	E	Oceanic summer resident
Turtle, Plymouth red-bellied	Chrysemys rubriventris bangsi	E	Plymouth & Dukes Counties
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	E	Entire state
Falcon, American peregrine	Falco peregrinus anatum	E	Entire state-reestablishment to former breeding range in progress
Falcon, Arctic peregrine	Falco peregrinus tundrius	E	Entire state migratory-no nesting
Plover, Piping	Charadrius melodus	T	Entire State - nesting habitat
MAMMALS:			
Cougar, eastern	Felis concolor couguar	E	Entire state - may be extinct
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp. (all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS:			
NONE			
PLANTS:			
Small Whorled Pogonia	Isotria meleoloides	E	Hampshire, Essex Counties

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service

Rev. 2/11/86

COASTAL ZONE
MANAGEMENT

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

10 July, 1986

Judith Johnson
Planning Division, Impact Analysis Branch
NED, U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

RE: Smith Cove, Gloucester, Section 107 Small Navigation Study

Dear Ms. Johnson:

This letter is in response to your request for comments regarding the above referenced project. While we welcome the opportunity to comment in the advanced stages of project planning and commend your office for the foresight to request such timely input, the following observations are preliminary. A formal federal consistency review will be conducted upon receipt of your consistency determination.

1. The bulk sediment analysis revealed highly elevated concentrations of lead, zinc and oil and grease, as well as significantly elevated concentrations of mercury, copper and vanadium. It appears that, according to 314 CMR 9.00, this material would be classified as Category III, Type B or C. This, as you know, significantly reduces disposal options.

2. The bioaccumulation testing indicated, contrary to the findings of the consultant, that the potential exists for bioaccumulation of PCB, as shown by the statistically significant accumulation of PCB in Palaemonetes. Given that the bioassay seemed to suggest that the material was suitable for ocean disposal and the PCB concentrations appear to be relatively low, our office will need further time to review the information and evaluate the results before any final recommendations can be made.

3. The results of the elutriate test indicate that copper concentrations exceed the EPA standard for at least half the replicates.

4. The benthic invertebrate study, while sufficient to provide a qualitative evaluation of the site, may be somewhat limited in its ability to afford a basis for quantitative analysis. Although a 0.5 mm seive was used (a welcome step beyond the usual 1 mm standard), given that two of the predominant organisms were Capitella spp. and Oligochaetes, both of which are quite small (especially the early life stages) and not always retained to an acceptable level on seives of this size, a finer mesh seive might have been considered.

5. Although the dredging does not appear to be within the Designated Port Area of Gloucester Inner Harbor, dredges and barges will presumably pass through this area. Consideration should be given to assuring that this activity does not interfere with normal commercial traffic within the Designated Port.

6. If you have not already done so, we would recommend that both the regional NMFS office and the Massachusetts DMF be contacted for comments at this time.

7. Reviewing the bathymetry, it would seem that most of the cove is already deep enough to allow adequate moorage for most recreational and small commercial vessels. Given the somewhat marginal character of the sediments, perhaps the scope of the project could be reduced, dredging only certain upper portions of the proposed turning basin.

Again, thank you for the opportunity to comment at this time. Should you have any questions, please feel free to contact me at 727-9530.

Sincerely,

Bradley W. Barr

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Management Division
Habitat Conservation Branch
2 State Fish Pier
Gloucester, MA 01930-3097

June 23, 1986 F/NER74:DB

Mr. Joseph L. Ignazio
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Dear Mr. Ignazio;

This is in response to your letter to Douglas Beach dated June 19, 1986, requesting a list of endangered or threatened species present in the area of a dredging project at Smith Cove in Gloucester, Massachusetts pursuant to Section 7(c) of the Endangered Species Act of 1973 (ESA).

We have identified the presence of no endangered or threatened species in the project area that come under the jurisdiction of the National Marine Fisheries Service. However, the Foul Area Disposal Site is inhabited by endangered humpback (Megaptera novaeangliae) and fir (Balaenoptera physalus) whales from May until October, and the endangered right whale (Balaena glacialis) inhabits the area from March through May. The type and quantity of material that will be disposed, the contaminant levels in the material, and more detail on the method and timing of the disposal must be clearly described in order to assess the potential effects of the project on the endangered species mentioned above.

For your information, we are attempting to reduce the need for duplicate responses on projects with marine resource and endangered species concerns. Henceforth, our field station representatives will address endangered species concerns in their initial response to any project. This should streamline the review process by including the preliminary Section 7 screening for the presence of endangered species in the initial review by our field staff. Therefore, for those projects where the Corps needs a written response under the ESA, please ask our field representative to incorporate endangered species concerns in their review. Should endangered species become a concern for any project, I will be notified by the field representative, and will become involved in the project review process if necessary. If you have any questions on this, please contact me at FTS 837-9254.

Sincerely,

Douglas W. Beach

Douglas W. Beach
Wildlife Biologist

The Commonwealth of Massachusetts
Office of the Secretary of State
Michael Joseph Connolly, Secretary

Massachusetts Historical Commission
Valerie A. Talmage
Executive Director
State Historic Preservation Officer

September 25, 1986

Mr. Joseph Ignazio
Chief, Planning Division
Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

RE: Proposed Navigation Improvements, Smith Cove, Gloucester

Dear: Mr. Ignazio:

My staff have reviewed materials which you submitted describing the proposed project referenced above. After review of the material, it has been determined that your proposal will not affect significant cultural, historical or archaeological resources.

This initial consultation to identify resources in the project area has been undertaken in accordance with 36 CFR 800, the Advisory Council Regulations for the Protection of Cultural Resources. Since no significant resources were identified in the vicinity of the proposal, no further compliance with Council Procedures is required.

If you should have any questions, please contact Jordan Kerber of this office. Thank you for your cooperation.

Sincerely,

Valerie Talmage

Valerie A. Talmage
Executive Director
State Historic Preservation Officer
Massachusetts Historical Commission

VAT/ls

80 Boylston Street, Boston, Massachusetts 02116 (617) 727-8470

WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DEFINITE PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

APPENDIX 1

ENGINEERING INVESTIGATIONS
DESIGN AND COST ESTIMATES

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

APPENDIX 1

ENGINEERING INVESTIGATIONS, DESIGN AND COST ESTIMATES

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APPENDIX 1
ENGINEERING AND INVESTIGATIONS
DESIGN AND COST ESTIMATES

INTRODUCTION

This appendix contains two sections. Section A outlines the various field activities and investigations conducted during the course of the detailed study. Section B provides a detailed analysis of the alternative Federal plans of improvement based on those investigations described in Section A.

SECTION A

DESCRIPTION OF PROJECT AREA

Smith Cove is located on the southeastern side of Gloucester Inner Harbor, Massachusetts. It is a rectangular shaped body of water approximately 820 feet wide and 1,300 feet long bordered at its northern end by the inner harbor. The east and west shores of the cove are scattered with several boat piers used mostly by commercial fishing vessels. There is a rock riprap embankment at the southern end of the cove. Water levels in the cove range from about 2 feet above mean low water (MLW) at the southern end to approximately 19 feet below MLW at the northern entrance.

FIELD INVESTIGATIONS

Field investigations were conducted during the detailed study to determine the ground surface elevation, type and composition of substrate, extent of ledge, and other physical characteristics that would effect plan formulation. This work included hydrographic surveys, subsurface investigations, and sediment analysis.

HYDROGRAPHIC SURVEYS

A hydrographic condition survey of Smith Cove was conducted in September 1983 by Tibbetts Engineering Corps. The results of this survey are shown in Figure 1-1.

SUBSURFACE INVESTIGATIONS

Drive sample borings and machine probes were completed to determine the characteristics and distribution of the overburden soil and to determine if any bedrock is located within the proposed dredge zone. Exploration depths were established based on maximum anticipated dredge depths in Smith Cove.

Test Borings

Test drive sample borings were conducted at the project site in April 1984. A total of three borings were made. Continuous drive sample borings were driven to a specified depth of -15.0 feet mlw or refusal using a 300lb hammer with an 18-inch drop where refusal is defined as 100 blows with no penetration or bouncing refusal. A 1 7/8-inch I.D. by 5-foot long solid barrel sampler was used to obtained soil samples. These borings were made in order to determine the type of material that would be encountered at various depths. A graphic representation of this information is summarized in subsequent sections and in the boring log summary shown in Figure 1-2. The locations of these borings are shown in Figure 1-3.

Machine Probings

Nine machine probings were performed in the project area in April 1984. The purpose of these probes was to establish the top elevation of any existing ledge in these areas. The machine probes were performed by advancing an open-end AW drill rod from the mudline to -15.0 feet mlw or refusal by the impact of a 300lb hammer falling freely through an 18-inch drop recording the number of blows per foot of penetration. A graphic representation of the results of these probes is summarized in Figure 1-2. The locations of all borings and probings made in Smith Cove are shown in Figure 1-3.

Foundation Conditions

Results of the subsurface investigation program conducted at Smith Cove is discussed below. Additional information including soil gradations and other physical test parameters is contained in subsequent sections. The stratigraphy of the soils in Smith Cove as portrayed by the information obtained from the machine probings and drive sample borings, is fairly consistent within the proposed dredge area. The upper 4 to 7 feet consists of very fine, gray to black, sandy organic silt. Beneath the sandy silt strata is a layer of gray sandy clay from -5 to -10 feet mlw with traces of shell fragments and a marine odor. Below -10 feet mlw a brown sandy clay was encountered by all three borings. Boring FD84-3 encountered granite bedrock at -10.3 feet mlw. Probe FP84-7, attempts 1 and 2, reached shallow refusal at elevations -5.5 feet and -10.2 feet mlw respectively. Probe FP84-1 encountered refusal at -13.4 feet mlw. No other probings or borings encountered bedrock. Based on the above, bedrock was determined to exist along the southwest side of the proposed anchorage.

NATURE OF THE MATERIAL TO BE REMOVED

In order to determine the nature of the material to be removed under each plan, sediment samples were taken from areas within the limits of the proposed improvements. Samples were obtained and analyzed in conjunction with the environmental sampling program. Soil samples were visually classified in the field and in the New England Division laboratory using the Unified Soil Classification System. The results of the subsurface investigations and physical testing reveal ledge on the southwest side of the proposed anchorage, which would require blasting activity for either of the proposed depths. All other material to be removed ranges from very fine silt to sandy clay.

Sediment Analysis

Samples were taken at six sites in October 1983 as part of the environmental sampling program. Samples from another five sites were taken in August 1985. All of these samples were taken using a tube sampling device. Physical tests consisting of mechanical sieve and hydrometer analysis, specific gravity, and percent solids were conducted on all samples. The quantity of material to be removed for each alternative plan of improvement is shown in Table 1-1. The location of all sediment sample sights are shown in Figure 1-4. The results of these tests are shown in Table 1-2 and Table 1-3. Grain size distribution curves developed from mechanical sieve analysis data are shown in Figures 1-5a thru 1-5k.

CHANNEL ANCHORAGE CROSS-SECTIONS

Data developed from the hydrographic survey and subsurface investigations were used to develop several representative cross-sections of the area selected for detailed study. In all areas a one foot allowable overdepth was assumed for ordinary material, and a two foot allowable overdepth for bedrock. Typical cross-sections for the areas to be dredged are shown in Figure 1-6, and the locations of these cross-sections appear in Figure 1-7.

QUANTITY ESTIMATES

In order to determine the quantity of material to be removed under each plan, quantity estimates were developed for selected dredge depths in the area chosen for detailed analysis. The incremental dredge quantities for each alternative plan are shown in Table 1-1.

TABLE 1-1
SMITH COVE, GLOUCESTER, MA.
QUANTITIES OF MATERIAL TO BE REMOVED

MATERIAL TO BE REMOVED	ESTIMATED CUBIC YARDS	ESTIMATED CONSTRUCTION TIME (WEEKS)
PLAN A		
Ordinary Material	22,300	2
Rock	540	1
	22,840	3
PLAN B		
Ordinary Material	33,300	4
Rock	975	1
	34,275	5
Plan C		
Ordinary Material	45,600	5
Rock	1,750	2
	47,350	7

TABLE 1-2
SMITH COVE, GLOUCESTER, MA.
OCTOBER 1983
PHYSICAL TEST RESULTS - MARINE SEDIMENT - ENVIRONMENTAL SAMPLES

PARAMETER	SITE A1	SITE B1	SITE C1	SITE D1
VISUAL CLASSIFICATION	Black organic gravelly, sandy silt (OH) with marine odor.	Gray organic sandy clay (OH) with marine odor.	Black organic sandy, silt (OH) with marine odor.	Black organic sandy, silt (OH) with marine odor.
Grain Size - Median (mm)	0.0500	0.0200	0.0180	0.0210
Grain Size - Median D75	0.6000	0.0650	0.0390	0.0320
Grain Size - Median D25	0.0170	0.0032	0.0150	0.0150
Sorting Coefficient	5.9409	4.5069	1.5916	1.4606
Normal (N) or Bimodal (B)	N	N	N	N
Specific Gravity	2.62	2.77	2.59	2.56
% Fines	55.0%	77.0%	92.0%	92.0%
Average Percent Solids	47.7%	45.9%	44.8%	36.3%
Liquid Limit	73.0	55.0	108.0	132.0
Plastic Limit	39.0	24.0	48.0	60.0
Plastic Index	34.0	31.0	60.0	72.0
Wet Unit Weight (PCF)	95.4	95.0	82.8	76.0
Dry Unit Weight (PCF)	56.9	64.1	36.6	28.2
% Volatile Solids - EPA (Average)	8.44%	7.92%	8.41%	10.43%
% Volatile Solids - NED (Average)	7.04%	6.06%	6.49%	7.49%

TABLE 1-2 (cont'd)
SMITH COVE, GLOUCESTER, MA.
OCTOBER 1983
PHYSICAL TEST RESULTS - MARINE SEDIMENT - ENVIRONMENTAL SAMPLES

PARAMETER	SITE E1	SITE F1
VISUAL CLASSIFICATION	Dark-Gray organic sandy silt (OH) with marine odor.	Dark-Gray organic sandy silt (OH) with marine odor.
Grain Size - Median (mm)	0.0230	0.0300
Grain Size - Median D75	0.0500	0.0600
Grain Size - Median D25	0.0150	0.0100
Sorting Coefficient	1.8257	2.4495
Normal (N) or Bimodal (B)	N	N
Specific Gravity	2.64	2.65
% Fines	82.0%	77.0%
Average Percent Solids	51.8%	44.2%
Liquid Limit	93.0	76.0
Plastic Limit	45.0	37.0
Plastic Index	48.0	39.0
Wet Unit Weight (PCF)	87.3	90.2
Dry Unit Weight (PCF)	40.3	46.3
% Volatile Solids - EPA (Average)	6.39%	9.88%
% Volatile Solids - NED (Average)	4.75%	7.83%

TABLE 1-3
SMITH COVE, GLOUCESTER, MA.
AUGUST 1985
PHYSICAL TEST RESULTS - MARINE SEDIMENT - ENVIRONMENTAL SAMPLES

PARAMETER	SITE A2	SITE B2	SITE C2	SITE D2	SITE E2
VISUAL CLASSIFICATION	Dark-Gray organic sandy silt (OH) with shell fragments.	Black organic sandy silt-clay (OH).	Black-olive-gray organic, silty clay (OH) with shell fragments.	Black organic sandy, clayey silt (OH) with shell fragments.	Black-olive gray gray organic, coarse to fine, sand (SM) with traces of gravel, shell, and organics.
Grain Size - Median (mm)	0.3200	0.0200	0.0350	0.0650	0.0900
Grain Size - Median D75	0.0550	0.0320	0.3000	0.4200	0.5500
Grain Size - Median D25	0.0130	0.0095	0.0130	0.0170	0.2500
Sorting Coefficient	2.0569	1.8353	4.8038	4.9705	1.4832
Normal (N) or Bimodal (B)	N	N	B	N	B
Specific Gravity	2.64	2.55	2.58	2.62	2.60
% Fines	80.0%	90.0%	63.0%	53.0%	48.0%
Average Percent Solids	45.9%	38.3%	53.4%	53.5%	53.1%
Liquid Limit	94.0	119.0	98.0	62.0	61.0
Plastic Limit	40.0	46.0	39.0	33.0	33.0
Plastic Index	54.0	73.0	60.0	29.0	28.0
Wet Unit Weight (PCF)	82.7	81.9	90.3	101.4	104.6
Dry Unit Weight (PCF)	40.6	35.1	50.4	66.1	67.7
% Volatile Solids - EPA (Average)	7.80%	11.60%	7.50%	7.40%	8.51%
% Volatile Solids - NED (Average)	5.60%	8.69%	4.00%	4.85%	5.96%

SECTION B

ANALYSIS OF PLANS

Three alternative plans were selected for detailed study. Plan A entails dredging of the channel and anchorage to a depth of -6 feet MLW, Plan B provides for a depth of -8 feet MLW, and Plan C calls for dredging to -10 feet at MLW. The three plans have identical channel and anchorage limits. All plans involve dredging and some blasting with the ordinary material and fragmented rock being removed by bucket dredge, placed in scows, and towed approximately 13 nautical miles east to the Foul Area (Environmental Protection Agency approved interim ocean disposal site) in Massachusetts Bay.

Costs provided include contingencies, mobilization and demobilization of the construction plant, a contractor profit of 10 percent, monies for supervision, administration, engineering, design, and new navigation aids. In order to accomplish the dredging, blasting, and disposal of ordinary material and rock under each plan, a typical construction plant consisting of the following equipment would be necessary: a dredge barge with a dredge and a 5 cy bucket; a drill rig for blasting attached to the dredge barge; a 1000 HP tug; a 165 HP launch; and two 1500 cy scows. Construction periods including time for mobilization and demobilization are estimated to be 3 weeks for Plan A, 5 weeks for Plan B, and 7 weeks for Plan C as shown previously in Table 1-3.

PLAN A

This plan, as shown in Figure 1-8, proposes construction of an access channel 6 feet deep at MLW, 80 feet wide by 800 feet long connecting an existing Federal channel at the northern end of the cove to a proposed 2.5 acre anchorage dredged to -6 feet MLW in the southern end of the cove.

Quantities of Material to be Removed

The amount of material to be removed under this plan is estimated at 540 cubic yards (cy) of rock and 22,300 cy of ordinary material. Minimal dredging is required in constructing the access channel due to its natural depths.

Cost Estimate

The cost estimate for dredging, blasting, and disposal under Plan A which is provided below in Table 1-4 is based on an estimated construction duration of 3 weeks. These quantities contain one foot of allowable overdepth for ordinary material and two feet for rock and are based on disposal of the dredged material at the Foul Area ocean site.

TABLE 1-4

PLAN A
SMITH COVE, GLOUCESTER, MA.
CONSTRUCTION COST ESTIMATE

Dredging	
Ordinary material - 22,300 cy @ $10.65/cy	$237,000
Rock removal - 540 cy @ $83.00/cy	45,000
Contingencies (20%)	56,000
Subtotal	$338,000
Engineering and Design	20,000
Supervision and Administration	38,000
Total First Cost	$396,000
Aids to Navigation	12,000
Total Improvement Costs	$408,000
Interest During Construction	N/A
Total Investment Cost	$408,000

PLAN B

This plan, depicted in Figure 1-9, proposes dredging a 8 foot deep, 80 foot wide by 800 foot long access channel from the northern end of the cove to a proposed 2.5 acre by -8 foot MLW anchorage in the southern end of the cove.

Quantities of Material to be Removed

The amount of material to be removed under this plan is estimated at 975 cy of rock and 33,300 cy of ordinary material. As with Plan A, minimal dredging is required for the 8 foot deep access channel due to natural depths.

Cost Estimate

The cost estimate for dredging, blasting, and disposal under Plan B, provided below in Table 1-5, is based on an estimated construction duration of 5 weeks. These quantities contain one foot of allowable overdepth for ordinary material and two feet for rock and are based on disposal of the dredged material at the Foul Area ocean site.

TABLE 1-5

PLAN B
SMITH COVE, GLOUCESTER, MA.
CONSTRUCTION COST ESTIMATE

Dredging		
Ordinary material - 33,300 cy @ $9.70/cy		$323,000
Rock removal - 975 cy @ $83.00/cy		81,000
Contingencies (20%)		81,000
Subtotal		$485,000
Engineering and Design		20,000
Supervision and Administration		46,000
Total First Cost		$551,000
Aids to Navigation		12,000
Total Improvement Costs		$759,000
Interest During Construction		2,100
Total Investment Cost		$761,100
	SAY	$761,000

PLAN C

Plan C proposes the construction of an access channel and anchorage with the same project limits and location as with Plan A and B, varying only in depth. As shown in Figure 1-10, PLan C calls for an acess channel 80 feet wide by -10 feet at MLW to a 2.5 acre anchorage also dredged to -10 feet MLW.

Quantities of Material to be Removed

The quantity of material to be removed from the construction of Plan C is estimated at 1,750 cubic yards of rock and 45,600 cubic yards of ordinary material.

Cost Estimate

The cost estimate for constructing Plan C includes blasting, dredging and disposal of the material at the Foul Area ocean site. Estimates of quantities of material to be removed contain one foot allowable overdepth for ordinary material and two feet for rock areas. The construction cost estimate for PLan C is provided in Table 1-6.

TABLE 1-6

PLAN C
SMITH COVE, GLOUCESTER, MA.
CONSTRUCTION COST ESTIMATE

Dredging	
Ordianry Material - 45,600 cy @ $9.10/cy	$415,000
Rock Removal - 1,750 cy @ $84.00/cy	147,000
Contingencies (20%)	112,000
Subtotal	$674,000
Engineering and Design	21,000
Supervision and Administration	57,000
Total First Cost	$752,000
Aids to Navigation	12,000
Total Improvement Cost	$764,000
Interest During Construction	2,000
Total Investment Cost	$766,000

AIDS TO NAVIGATION

Specific costs for aids to navigation are obtained from the U.S. Coast Guard, which is responsible for placing and maintaining any aids they deem necessary for boating safety. For purposes of this draft report, assumptions were made regarding the quantity and type of aids required for the alternative plans.

As the improvement plans propose the same access channel location, length, and width, required aids to navigation would be identical. For both plans it was assumed that 3 new navigation aids would be required. One steel can buoy to mark the channel entrance and two additional buoys to mark the channel limits. Each steel can buoy is estimated to cost $4,000.

DISPOSAL OF DREDGED MATERIAL

For both plans, ocean disposal at the Foul Area in Massachusetts Bay is the preferred site. The Foul Area is an EPA approved interim ocean disposal site. The material removed by bucket dredge would be placed in scows and towed approximately 13 nautical miles east to the disposal site. Some method of controlled dumping would be employed to minimize dispersal at the disposal site. The Foul Area has been extensively studied by Federal and State agencies to ensure its continued suitability as an ocean disposal site. Conditions at the disposal site are monitored under the New England Division Disposal Area Monitoring System program. Possible upland sites were investigated, however no suitable site was available.

MAINTENANCE COSTS

Maintenance of the navigation improvements proposed under each plan would be necessary at estimated intervals throughout the 50-year project life. Maintenance of the channel and anchorage to their authorized dimensions would be necessary to ensure the continued efficiency of the developed harbor.

Maintenance Dredging

Following construction dredging, the channel and anchorage would tend to shoal or fill in due to settlement of material from side slopes, deposition of material derived from upland erosion, and from current and tidal action.

Although channel side slopes would be designed in such a way as to enhance long-term stability, changes to the bottom contours would occur over time resulting in a gradual flattening of the slopes. Strong current action occurring during storms may result in the movement of bottom sediments. The propeller wash and waves produced by passing vessels would also tend to disturb the anchorage and channel bottom, resulting in redistribution of bottom sediments.

Smith Cove is a very small, enclosed cove bounded by rock with no tributaries, therefore, deposition of sediments within the project area to be dredged is estimated not to exceed an annual rate of 2 percent of the total volume to be removed under each plan. As depths within the proposed project area are progressively diminished by shoaling, project efficiency would be gradually reduced. Maintenance dredging would become necessary to prevent a severe reduction in project efficiency. This is estimated to occur when shoals over the entire project area reach levels of about 2 feet above the original dredge depth. This would occur approximately once every 15 to 20 years. The total dredge area includes the project limits to be dredged under each plan and the extent of area outside those limits altered to form side slopes. The annual shoal quantity is determined as being 2 percent of the improvement dredging quantity under each plan. The amount of material required to reduce depths by 2 feet over the dredge area of each plan is determined as shown in Table 1-7 and divided by the annual 2 percent shoal quantity to obtain the maintenance frequency requirement for each plan.

Price per cubic yard for maintenance activities for each plan are determined based on the volume of material to be removed. This unit price is then multiplied by the annual shoal quantity to determine the annual cost of maintenance dredging. Annual maintenance dredging charges include allowances for removal and disposal of material to be dredged, mobilization and demobilization of the construction plant, contractor profit, contingencies, engineering and design, supervision, and administration costs.

In the future it may be required that in order to accomplish maintenance dredging activities an upland disposal sight would have to be secured. It would be a local responsibility to locate such an upland disposal sight and fund construction of any necessary features as defined in the items of local assurances found in the main report.

TABLE 1-7
SMITH COVE, GLOUCESTER, MA.
MAINTENANCE DREDGING ESTIMATES

	PLAN A	PLAN B	PLAN C
Total Dredging Area project limits plus Side Slopes (Acres)	3.3	3.6	3.8
Volume of Shoals (cy) to reach two feet	12,500	13,200	13,900
Total Improvement Dredging Quantity (cy of ordinary material & rock)	22,840	34,275	47,350
2% Annual Shoal Quantity (cy)	446	666	912
Maintenance Dredging Frequency (years)	28	20	15
Maintenance Dredging Cost Per Cubic Yard (estimated 1986 cost for volume at 2 foot shoals plus contingencies, E&D, S&M, etc.)	$13.00	$13.00	$13.00
Annual Maintenance Dredging Cost	$5,800	$8,700	$11,900

Maintenance of Aids to Navigation

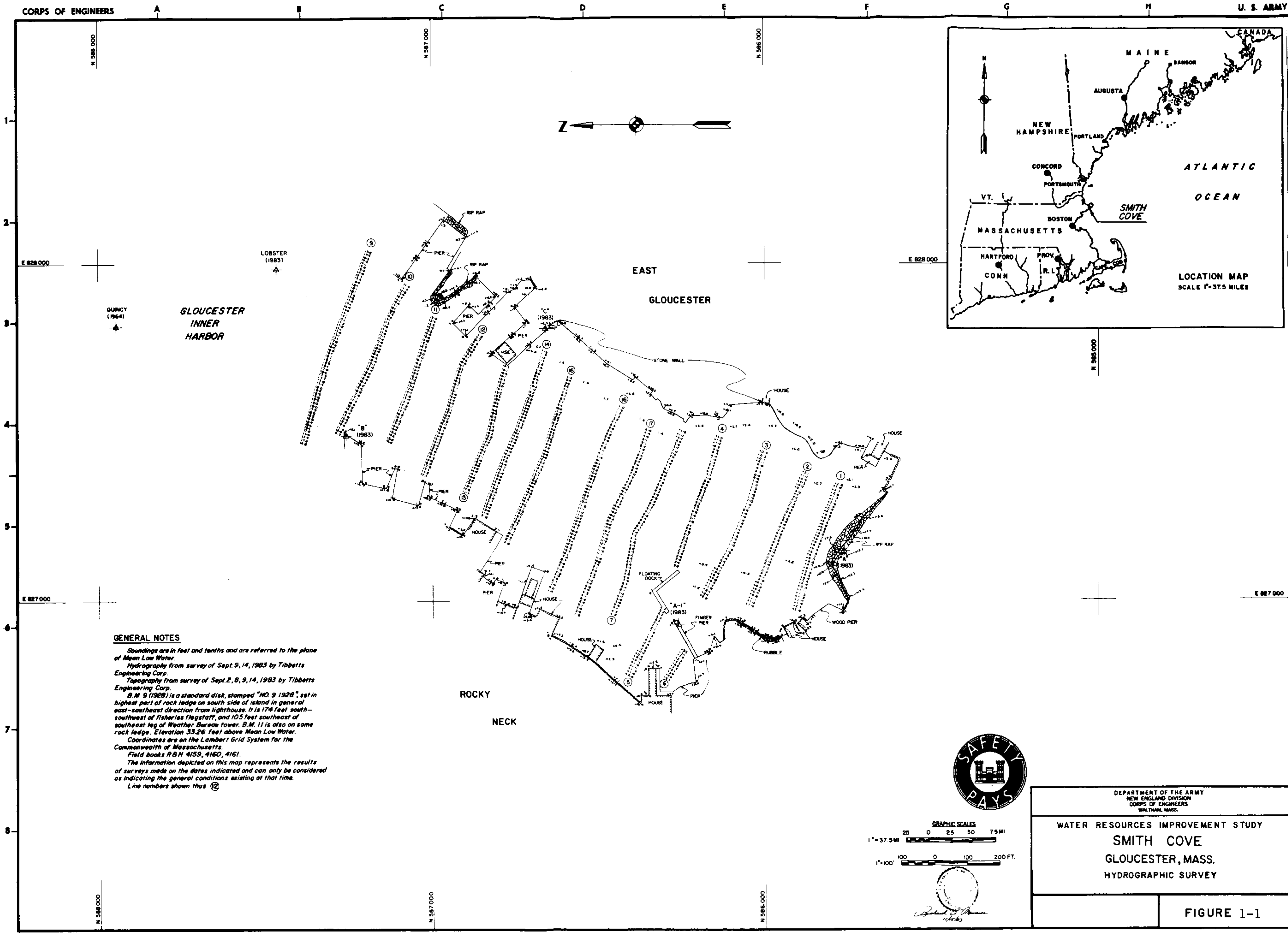
Maintenance of aids to navigation is the responsibility of the U.S. Coast Guard. Steel can buoys, as proposed, have a life of about 20 years and would therefore require replacement twice during the project life. Other buoy maintenance includes painting, and anchor chain replacement every 2 years, and removal of buoys subjected to winter icing. The annual maintenance charge for a steel can buoy is estimated at $500.

ANNUAL CHARGES

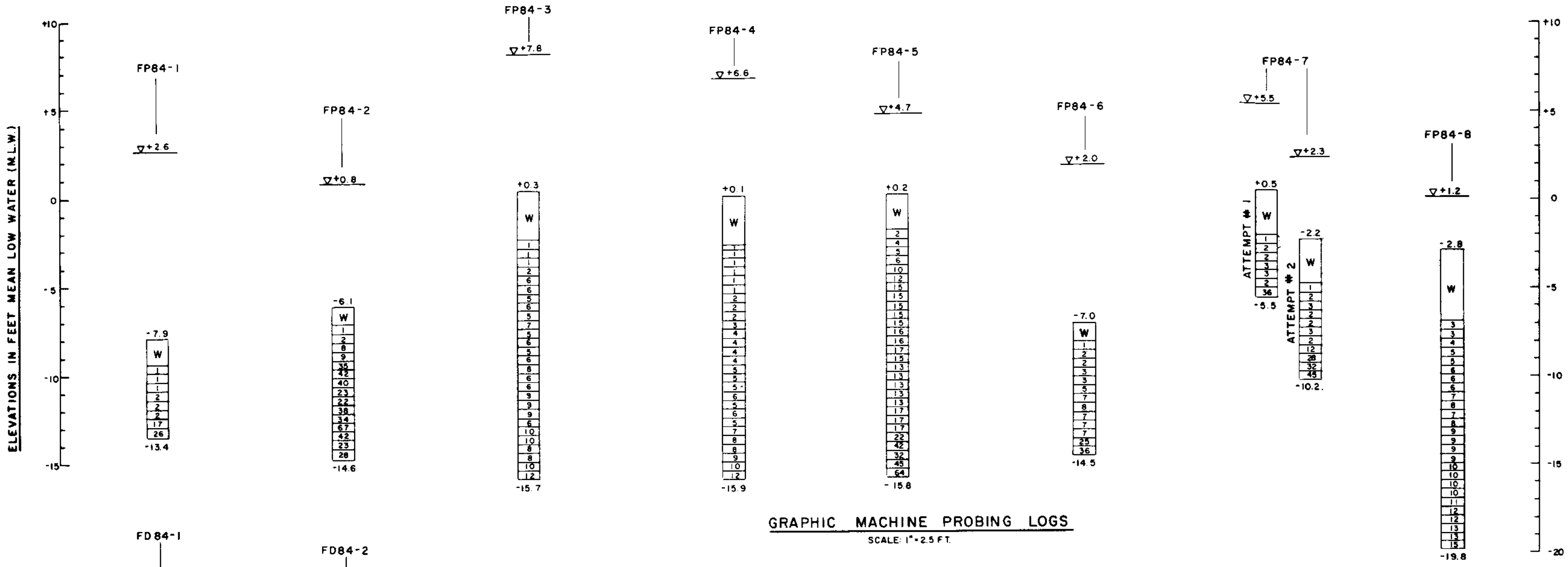
Annual charges assessed to each detailed plan are a combination of the various annual maintenance costs and the annual interest and amortization charge resulting from the first cost of improvement assessed over the 50-year project life. The charge for interest and amortization is based on a Federal annual interest rate of 8 7/8 percent. The annual charges and total construction costs for each plan are shown in Table 1-8.

TABLE 1-8
SMITH COVE, GLOUCESTER, MA.
SUMMARY OF ANNUAL CHARGES

	PLAN A	PLAN B	Plan C
Amortization of Total Investment Cost (Plan A - 0.09003 x $408,000) (Plan B - 0.09003 x $564,000) (Plan C - 0.09003 x $766,000)	$37,000	$51,000	$69,000
Maintenance Dredging	$6,000	$9,000	$12,000
Maintenance of Navigation Aids	$2,000	$2,000	$2,000
TOTAL ANNUAL CHARGES	$45,000	$62,000	$83,000

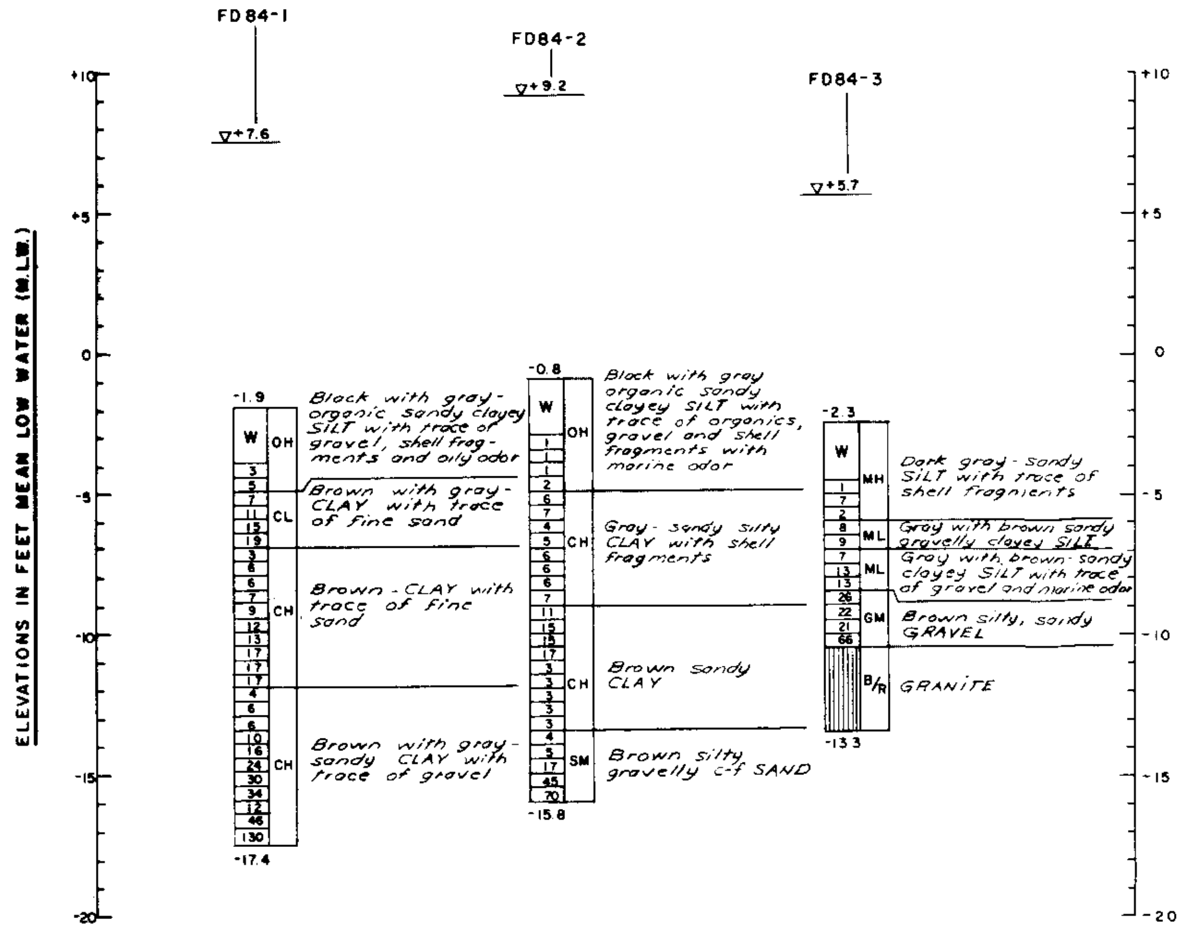


CORPS OF ENGINEERS
U. S. ARMY
GLOUCESTER INNER HARBOR
EAST GLOUCESTER
ROCKY NECK
QUINCY (1964)
LOBSTER (1983)
"B" (1983)
"C" (1983)
"A" (1983)
"A-1" (1983)
RIP RAP
PIER
HSE
HOUSE
STONE WALL
FLOATING DOCK
FINGER PIER
WOOD PIER
RUBBLE
E 828 000
E 827 000
N 588 000
N 587 000
N 586 000
N 585 000
MAINE
CANADA
BANGOR
AUGUSTA
NEW HAMPSHIRE
PORTLAND
CONCORD
PORTSMOUTH
VT.
MASSACHUSETTS
BOSTON
SMITH COVE
ATLANTIC OCEAN
HARTFORD
CONN
PROV.
R.I.
LOCATION MAP
SCALE 1"=37.5 MILES
GENERAL NOTES
Soundings are in feet and tenths and are referred to the plane of Mean Low Water.
Hydrography from survey of Sept. 9, 14, 1983 by Tibbetts Engineering Corp.
Topography from survey of Sept. 2, 8, 9, 14, 1983 by Tibbetts Engineering Corp.
B.M. 9 (1928) is a standard disk, stamped "NO. 9 1928", set in highest part of rock ledge on south side of island in general east-southeast direction from lighthouse. It is 174 feet south-southwest of fisheries flagstaff, and 105 feet southeast of southeast leg of Weather Bureau tower. B.M. 11 is also on same rock ledge. Elevation 33.26 feet above Mean Low Water.
Coordinates are on the Lambert Grid System for the Commonwealth of Massachusetts.
Field books R.B.H 4159, 4160, 4161.
The information depicted on this map represents the results of surveys made on the dates indicated and can only be considered as indicating the general conditions existing at that time.
Line numbers shown thus 12
SAFETY PAYS
GRAPHIC SCALES
1"=37.5 MI
25 0 25 50 75 MI
1"=100'
100 0 100 200 FT.
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
HYDROGRAPHIC SURVEY
FIGURE 1-1



GRAPHIC MACHINE PROBING LOGS

SCALE: 1" = 2.5 FT.



GRAPHIC BORING LOGS

SCALE 1" = 2.5 FT.

NOTES:

1. SUBSURFACE EXPLORATIONS, INCLUDING 8 MACHINE PROBINGS AND 3 DRIVE SAMPLE BORINGS WERE CONDUCTED IN APRIL, 1984. A 12 X 16 FOOT WOODEN RAFT AND PORTABLE DRILL RIG WERE USED TO PERFORM EXPLORATIONS.
2. LOCATIONS FOR ALL EXPLORATIONS WERE SITED BY SEXTANT ANGLES.
3. DATUM USED FOR ALL EXPLORATIONS IS MEAN LOW WATER (M.L.W.).
4. ALL MACHINE PROBINGS WERE DRIVEN USING A-W SIZE DRILL RODS AND A 300 LB. HAMMER WITH AN 18" DROP.
5. ALL DRIVE SAMPLE BORINGS WERE PERFORMED USING A 2 1/2" I.D. SOLID BARREL SAMPLER, CONTINUOUSLY SAMPLING AT 5 FOOT INTERVALS. THE SAMPLER WAS DRIVEN WITH A 300 LB. HAMMER AT AN 18" DROP.

LEGEND

GRAPHIC PROBING LOGS

FP84-9 MACHINE PROBE NUMBER

▽+5.5 WATER LEVEL ELEVATION

-5.0 ELEVATION OF GROUND SURFACE AT TOP OF PROBING (MLW).

3 BLOWS PER 6-INCH OF PENETRATION, USING 300 LB. HAMMER, 18" DROP AND A-W SIZE DRILL ROD.

-8.5 ELEVATION AT BOTTOM OF PROBING (MLW).

GRAPHIC BORING LOGS

FD84-4 DRIVE SAMPLE BORING NUMBER

▽+1.0 WATER LEVEL ELEVATION

-7.5 ELEVATION OF GROUND SURFACE AT TOP OF BORING (MLW).

2 BLOWS PER 6-INCH OF PENETRATION USING 300 LB. HAMMER, 18" DROP AND 2 1/2" I.D. 5 FOOT LONG SOLID BARREL SAMPLER.

ML SOIL CLASSIFICATION SYMBOL (UNIFIED SOIL CLASSIFICATION SYSTEM.)

B/R TYPE OF ROCK CORED.

-12.5 ELEVATION AT BOTTOM OF BORING (MLW).

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

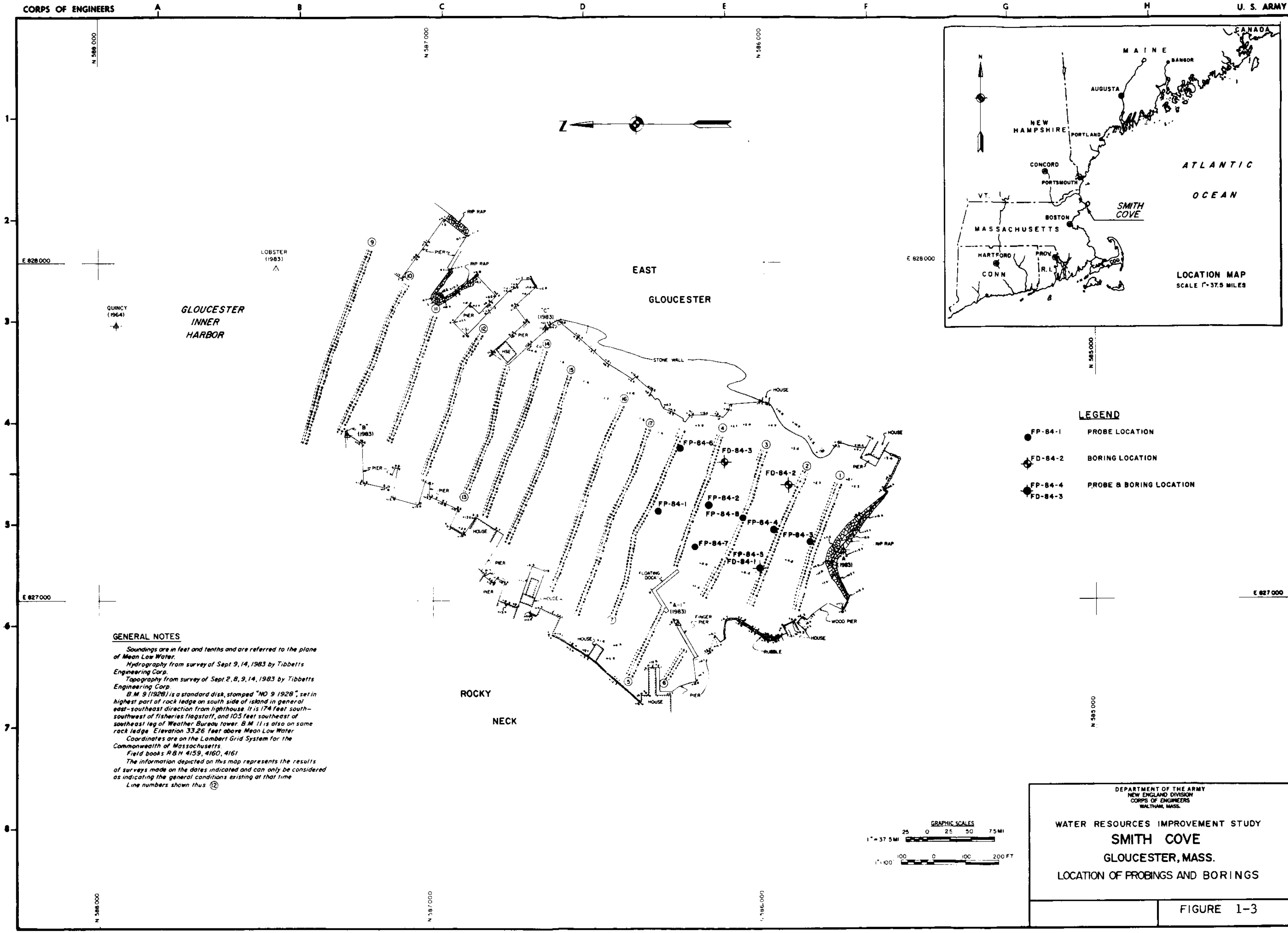
WATER RESOURCES IMPROVEMENT STUDY

SMITH COVE

GLOUCESTER, MASS.

GRAPHIC MACHINE PROBING AND BORING LOGS

FIGURE 1-2



GENERAL NOTES

Soundings are in feet and tenths and are referred to the plane of Mean Low Water.

Hydrography from survey of Sept. 9, 14, 1983 by Tibbetts Engineering Corp.

Topography from survey of Sept. 2, 8, 9, 14, 1983 by Tibbetts Engineering Corp.

B.M. 9 (1928) is a standard disk, stamped "NO 9 1928", set in highest part of rock ledge on south side of island in general east-southeast direction from lighthouse. It is 174 feet south-southwest of fisheries flagstaff, and 105 feet southeast of southeast leg of Weather Bureau tower. B.M. 11 is also on same rock ledge. Elevation 33.26 feet above Mean Low Water.

Coordinates are on the Lambert Grid System for the Commonwealth of Massachusetts.

Field books R.B.H. 4159, 4160, 4161

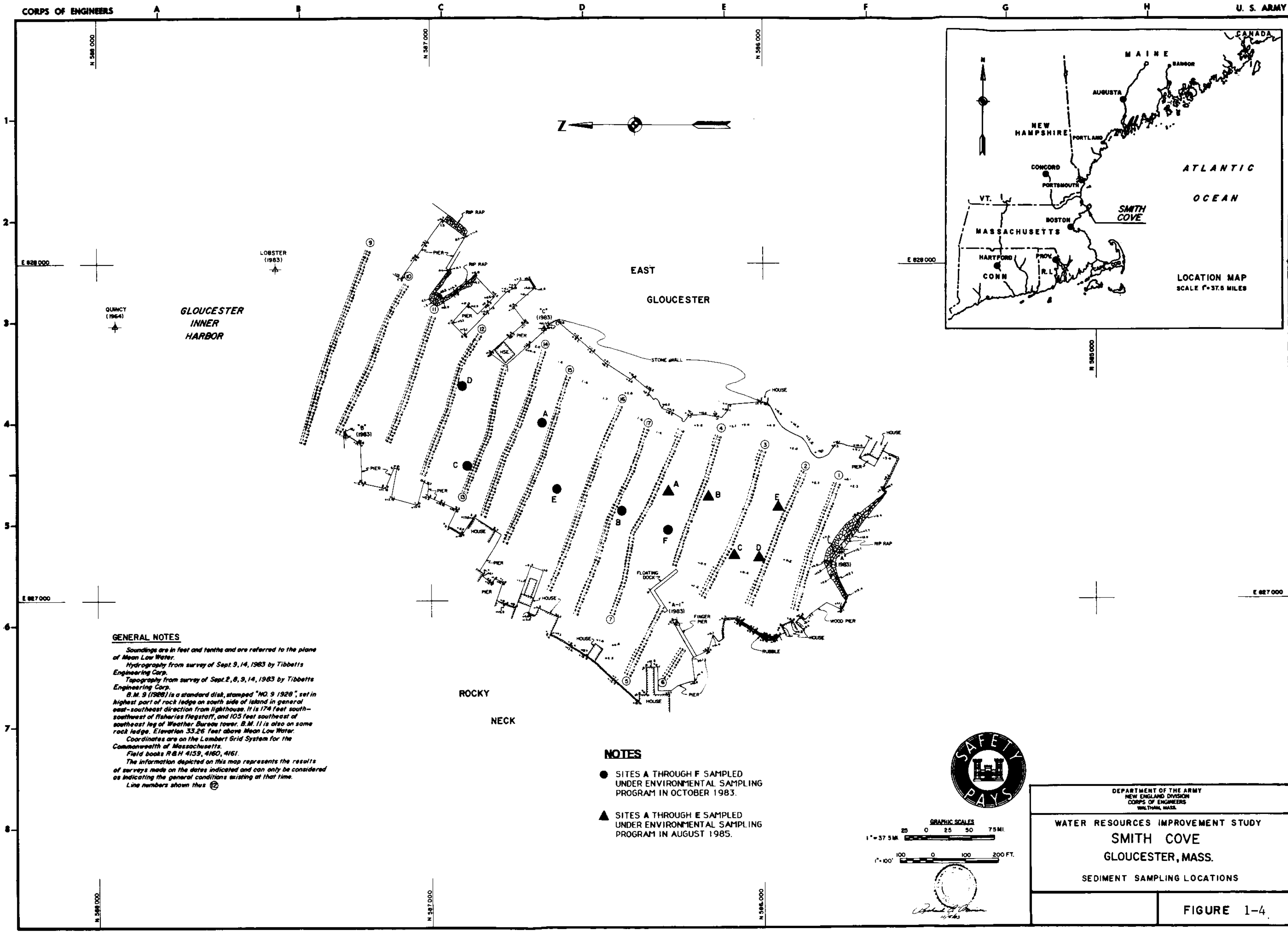
The information depicted on this map represents the results of surveys made on the dates indicated and can only be considered as indicating the general conditions existing at that time.

Line numbers shown thus 12

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
LOCATION OF PROBINGS AND BORINGS

FIGURE 1-3



CORPS OF ENGINEERS
U. S. ARMY
EAST
GLOUCESTER
GLOUCESTER
INNER
HARBOR
ROCKY
NECK
LOBSTER
(1983)
QUINCY
(1964)
STONE WALL
FLOATING DOCK
FINGER PIER
RIP RAP
RUBBLE
WOOD PIER
HOUSE
PIER
MAINE
BANGOR
AUGUSTA
NEW
HAMPSHIRE
PORTLAND
CONCORD
PORTSMOUTH
VT.
MASSACHUSETTS
BOSTON
SMITH
COVE
HARTFORD
CONN
PROV.
R.I.
CANADA
ATLANTIC
OCEAN
LOCATION MAP
SCALE 1" = 37.5 MILES
GENERAL NOTES
Soundings are in feet and tenths and are referred to the plane of Mean Low Water.
Hydrography from survey of Sept. 9, 14, 1983 by Tibbetts Engineering Corp.
Topography from survey of Sept. 2, 8, 9, 14, 1983 by Tibbetts Engineering Corp.
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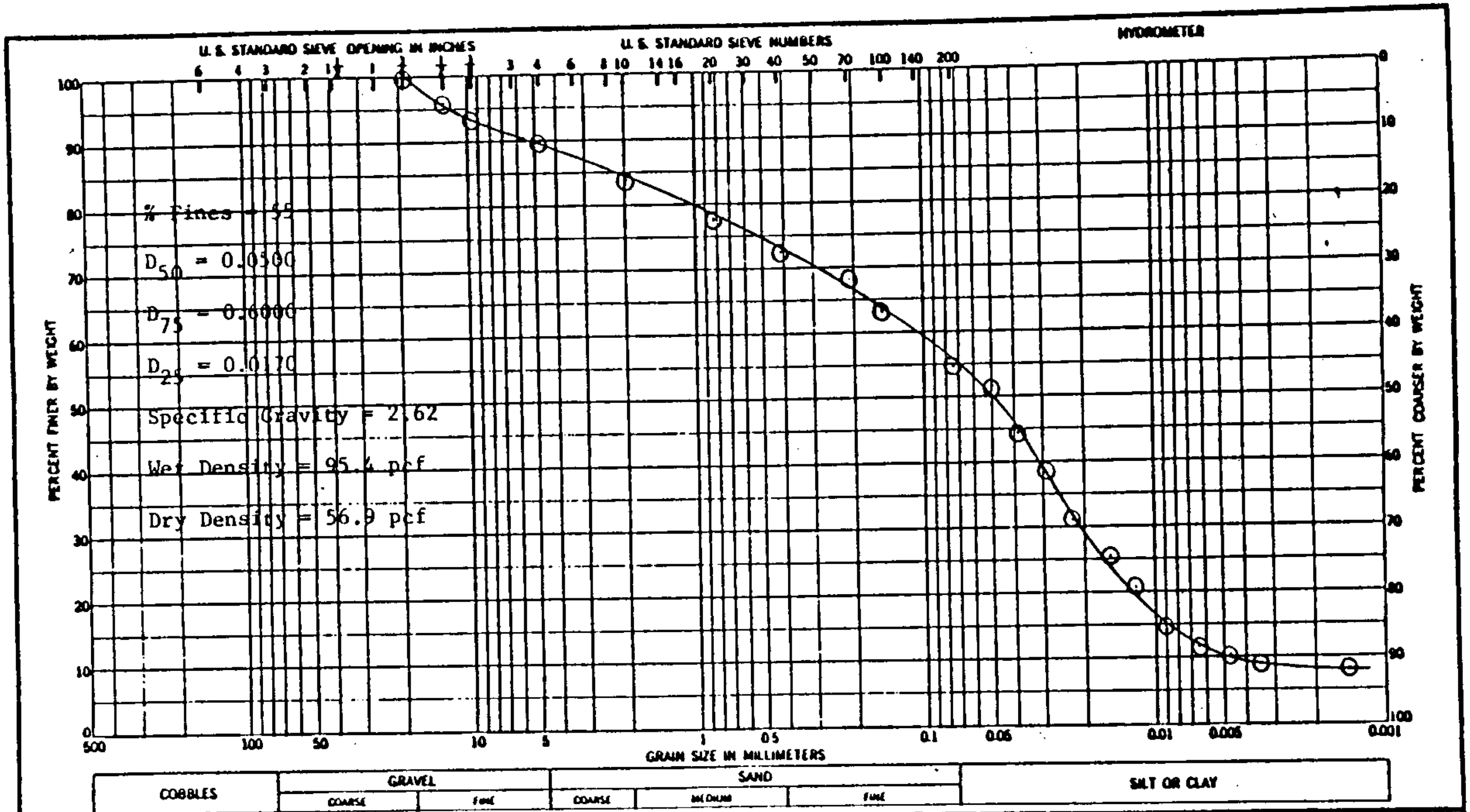
Coordinates are on the Lambert Grid System for the Commonwealth of Massachusetts.
Field books R&H 4159, 4160, 4161.
The information depicted on this map represents the results of surveys made on the dates indicated and can only be considered as indicating the general conditions existing at that time.
Line numbers shown thus 12
NOTES
● SITES A THROUGH F SAMPLED UNDER ENVIRONMENTAL SAMPLING PROGRAM IN OCTOBER 1983.
▲ SITES A THROUGH E SAMPLED UNDER ENVIRONMENTAL SAMPLING PROGRAM IN AUGUST 1985.
SAFETY PAYS
GRAPHIC SCALES
1" = 37.5 MI. 25 0 25 50 75 MI.
1" = 100' 100 0 100 200 FT.
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
SEDIMENT SAMPLING LOCATIONS

FIGURE 1-4

FIGURE 1-5A



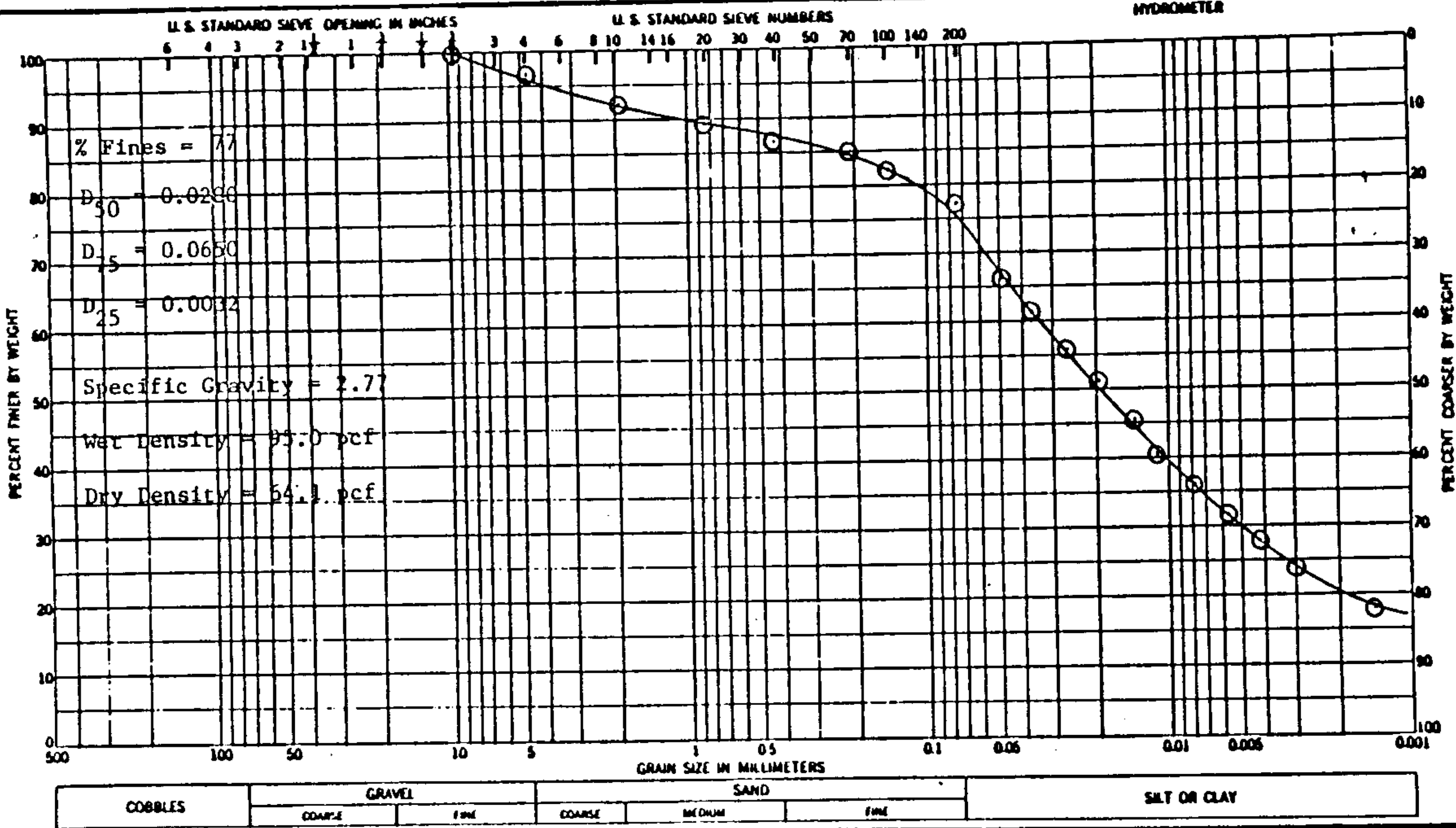
Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-A1	0.0-0.9 ft	Black organic gravelly, sandy,silt (OH) with marine odor.	68	73	39	34

Project: Smith Cove Gloucester, Ma.
Area: Sediment Sieve Analysis
Boring No.: Site-A1
Date: October 1983

GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 820-280



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-B1	0.0-0.80 ft	Gray organic sandy clay(OH) with marine odor	48	55	24	31

Project: Smith Cove, Gloucester, Ma.

Area: Sediment Sieve Analysis

Boring No.: Site-B1

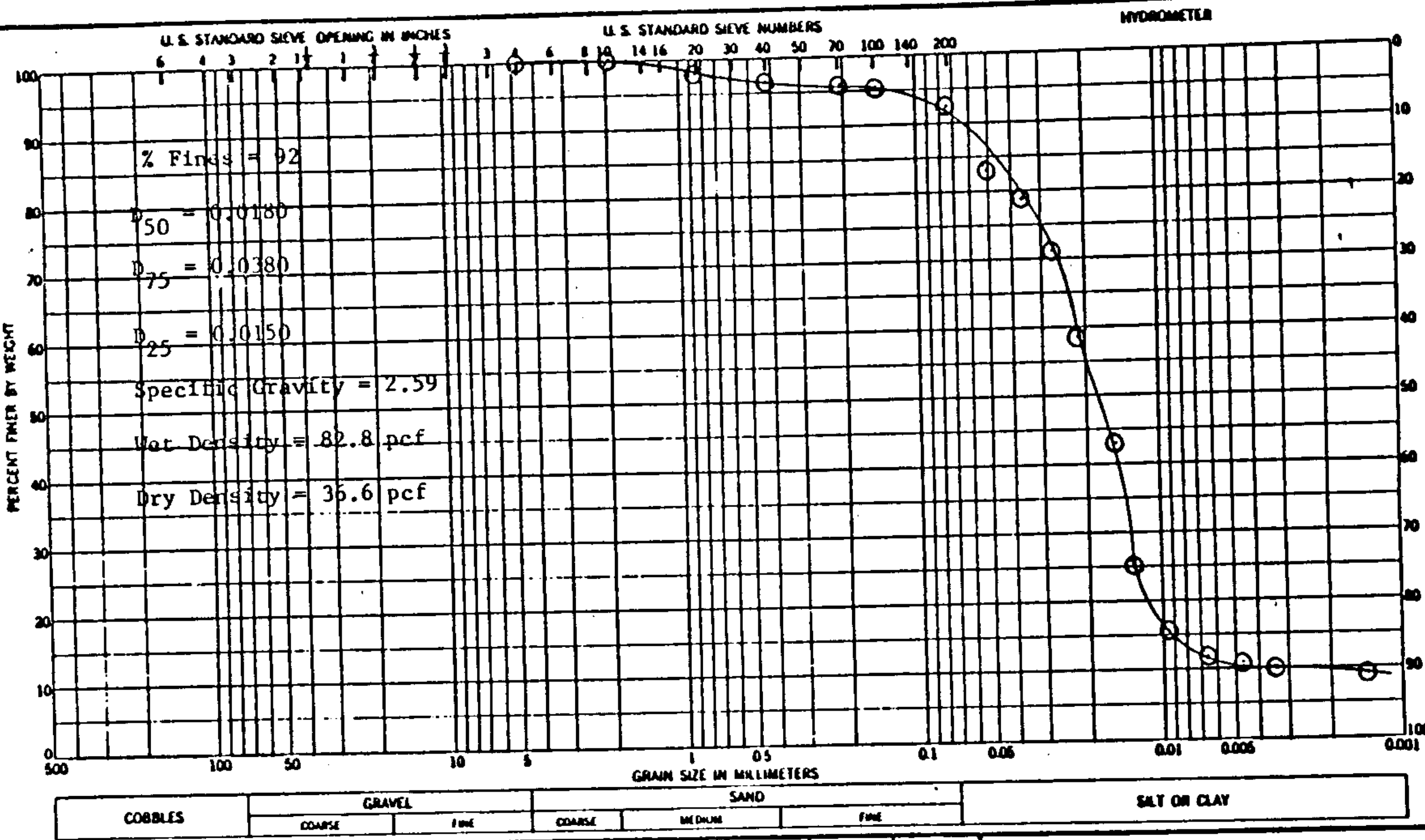
Date: September 1983

GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 920-260

FIGURE 1-5B



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-C1	0.0-1.1 ft	Black organic sandy silt (OH) with marine odor.	127	108	48	60

Project: Smith Cove
Gloucester, Ma.
Area: Sediment Sieve Analysis
Boring No.: Site-C1
Date: September 1983

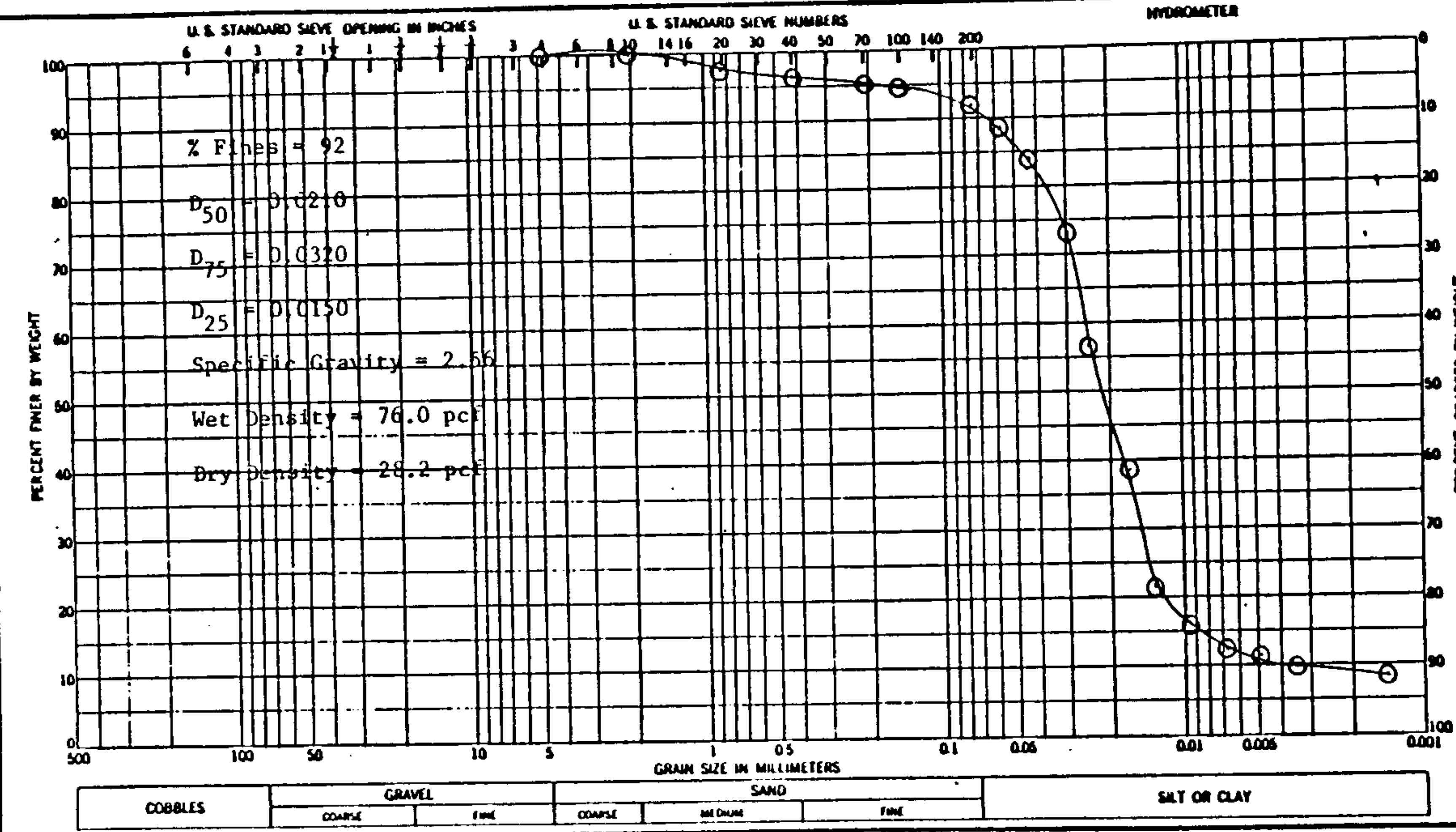
GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 920-280

FIGURE 1-5C

FIGURE 1-5D



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-D1	0.0-1.3 ft	Black organic sandy silt (OH) with marine odor.	170	132	60	72

Project Smith Cove
Gloucester, Ma.
Area Sediment Sieve Analysis
Boring No. Site-D1
Date September 1983

GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 920-250

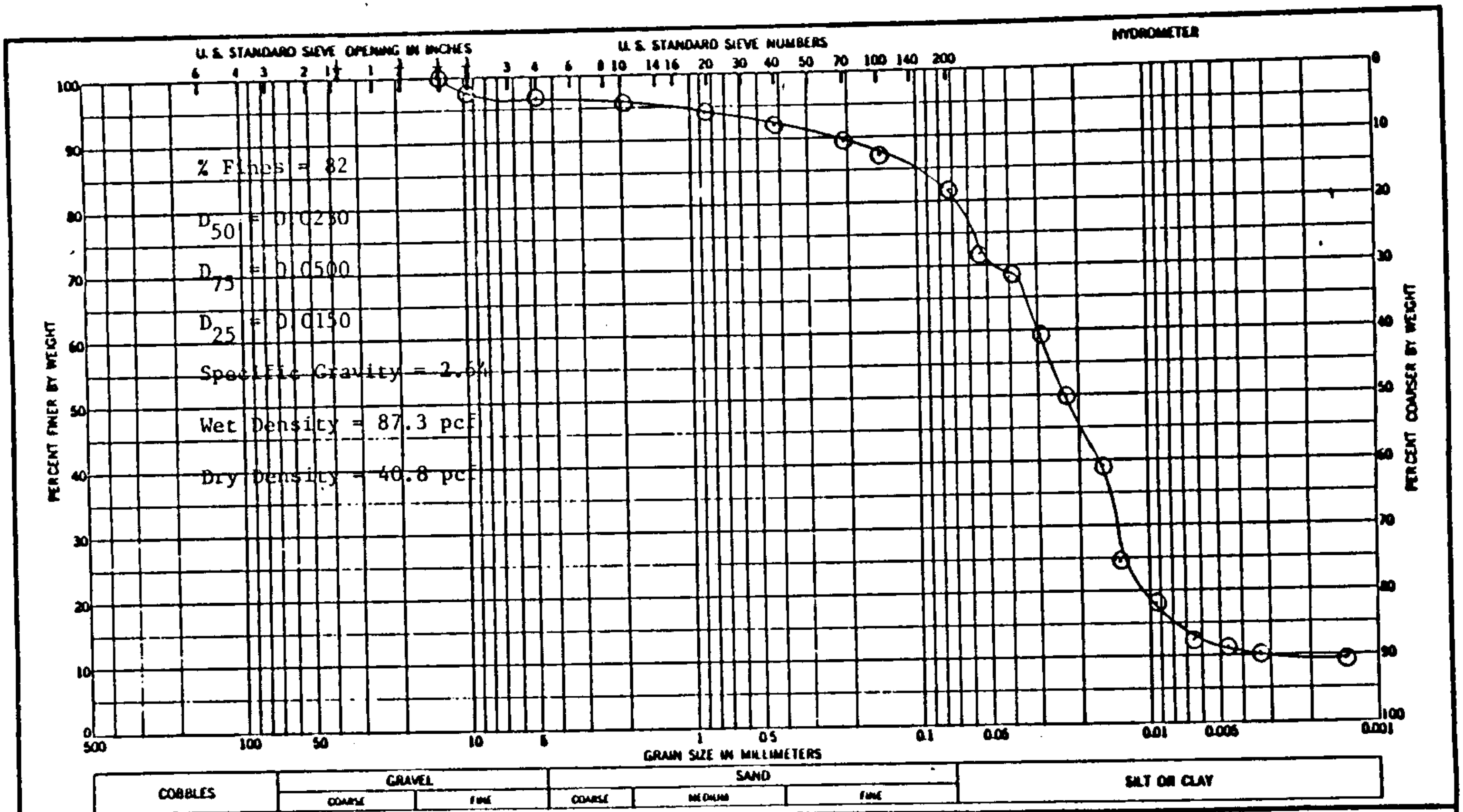


FIGURE 1-5E

Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-El	0.0-1.2 ft	Dark gray organic sandy silt (OH) with marine odor.	114	93	45	48

Project Smith Cove
Gloucester, Ma.

Area Sediment Sieve Analysis

Boring No. Site-El

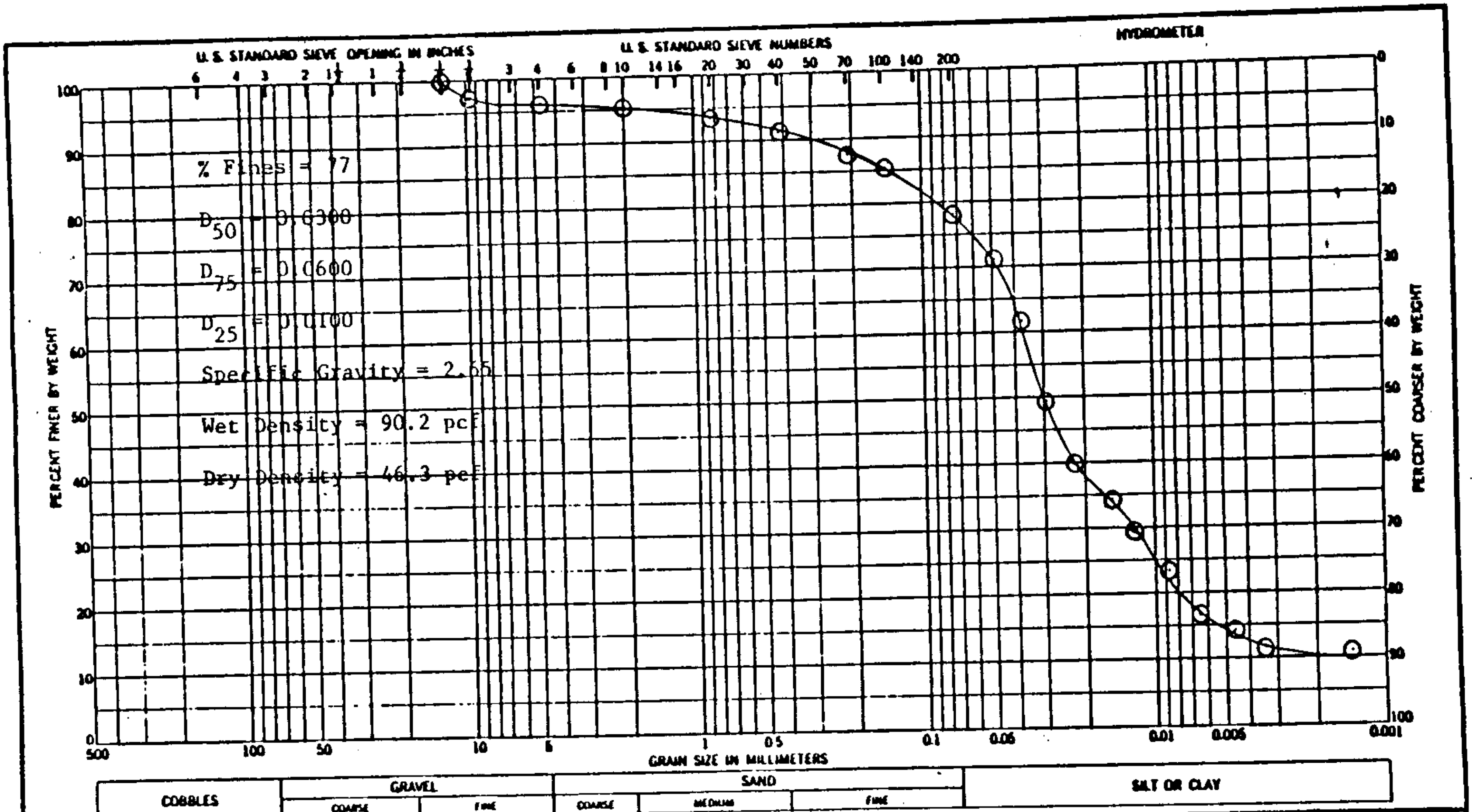
Date September 1983

GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 920-260

FIGURE 1-5F



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-F1	0.0-1.04 ft	Dark grey organic sandy silt (OH) with marine odor	94	76	37	39

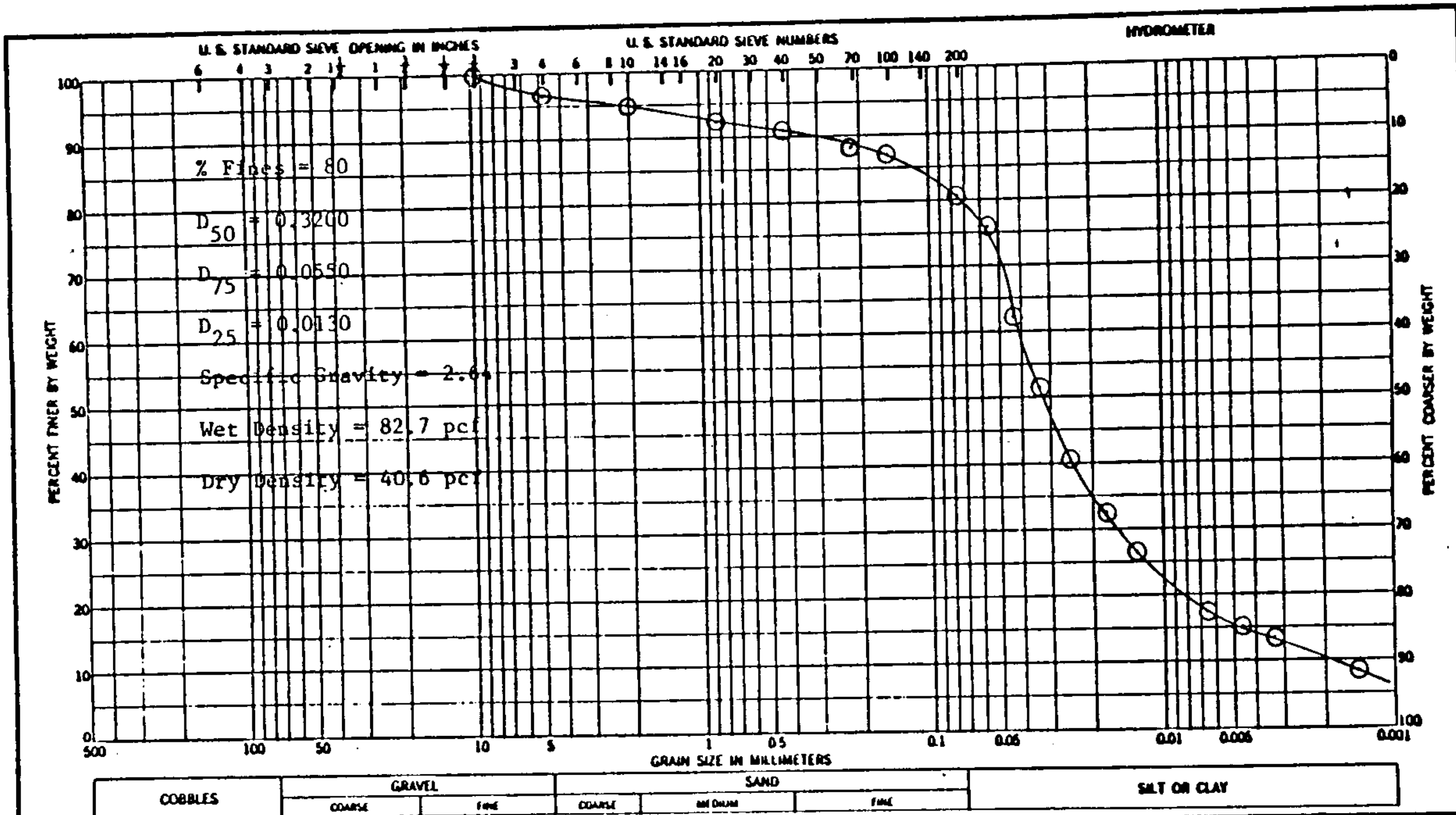
Project	Smith Cove
	Gloucester, Ma.
Area	Sediment Sieve Analysis
Boring No.	Site-F1
Date	September 1983

GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 820-280

FIGURE 1-5G



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-A2	0.0-1.45 ft	Dark-gray organic sandy silt-clay (OH) with shell fragments.	104	94	40	54

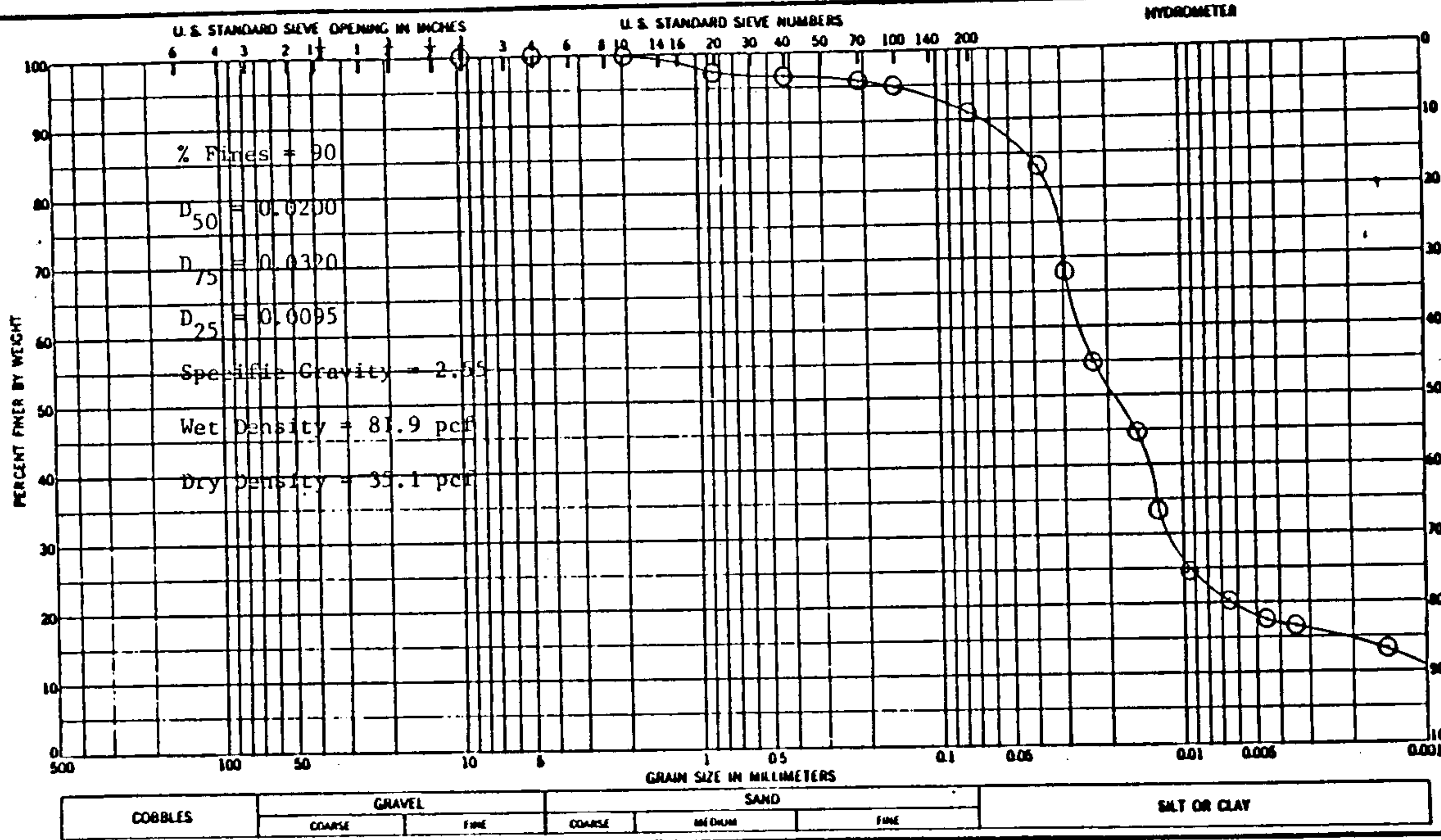
Project Smith Cove
Gloucester, Ma.
Area Sediment Sieve Analysis
Boring No. Site-A2
Date August 1985

GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 820-280

FIGURE 1-5H



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-B2	0.0-1.4 ft	Black organic sandy silt-clay (OH).	133	119	46	73

Project: Smith Cove
Gloucester, Ma.

Area: Sediment Sieve Analysis

Boring No.: Site-B2

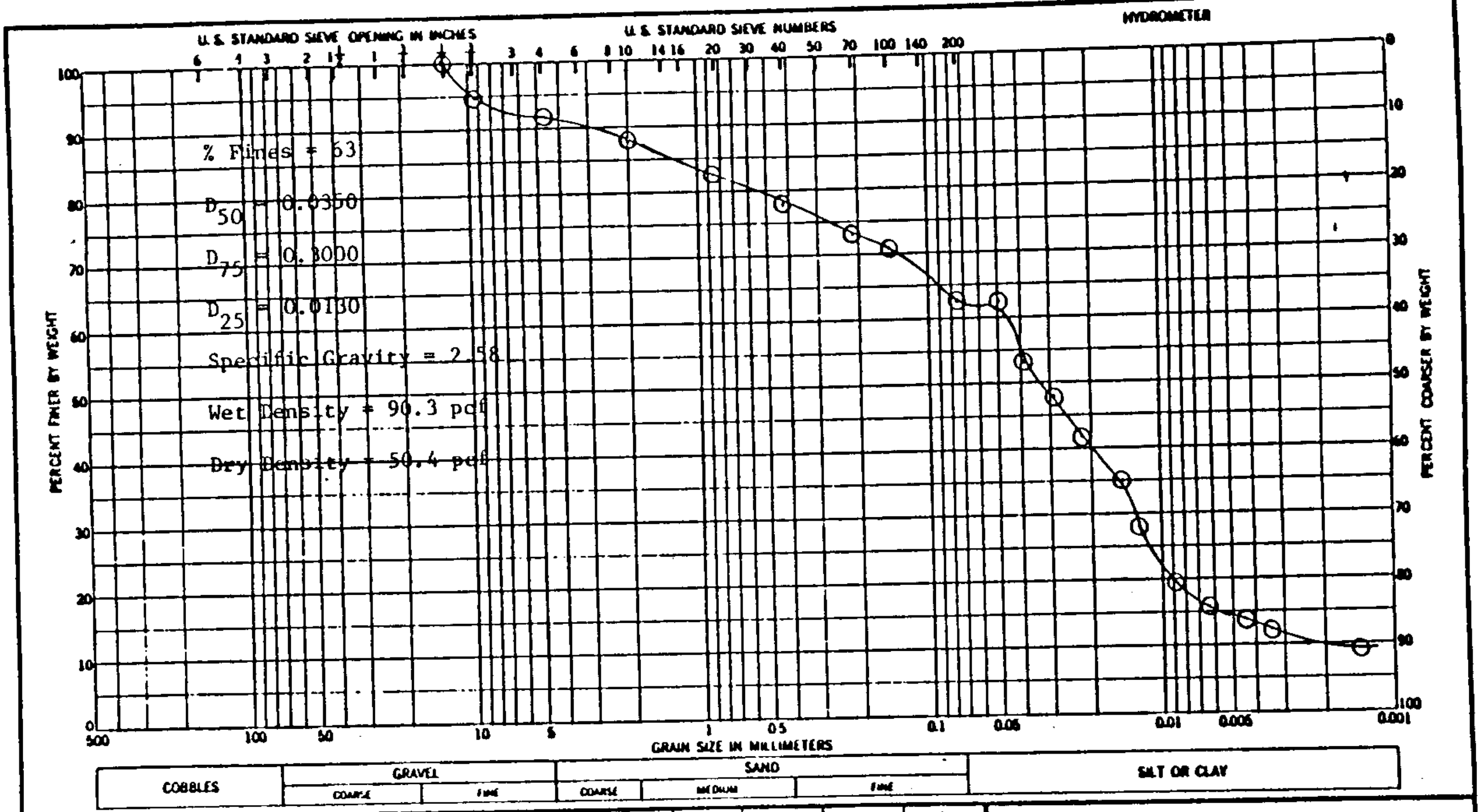
Date: August 1985

GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 820-280

FIGURE 1-51



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-C2	0.0-1.4 ft	Black-olive gray organic silty clay (OH) with shell fragments.	79.3	98	39	60

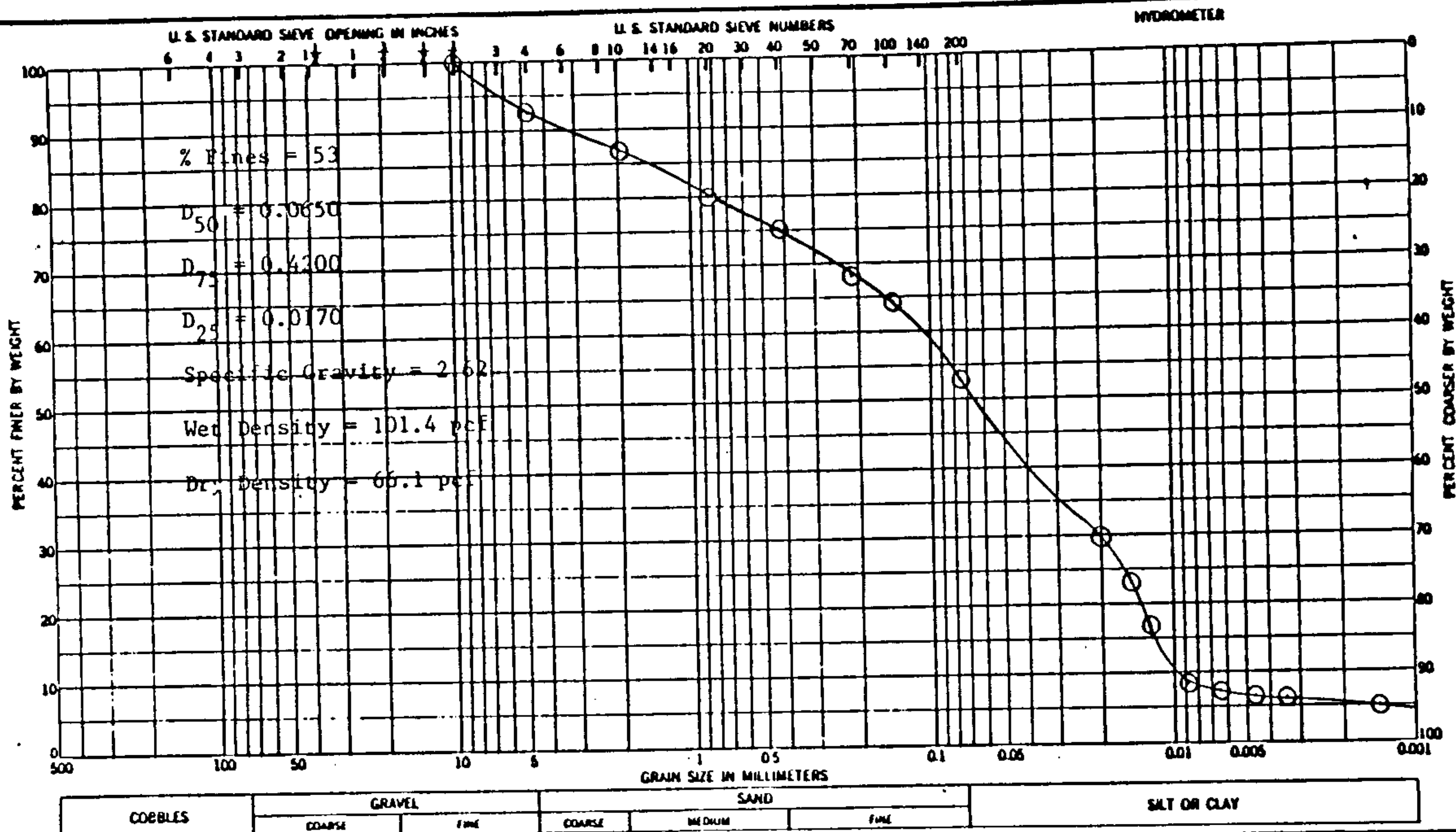
Project	Smith Cove Gloucester, Ma.
Area	Sediment Sieve Analysis
Boring No.	Site-C2
Date	August 1985

GRADATION CURVES

GPO 820-260

ENG FORM 1 MAY 63 2087

FIGURE 1-5J



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-D2	0.0-0.8 ft	Black organic sandy, clayey silt (OH) with shell fragments.	53.3	62	33	29

Project: Smith Cove

Gloucester, Ma.

Area: Sediment Sieve Analysis

Boring No.: Site-D2

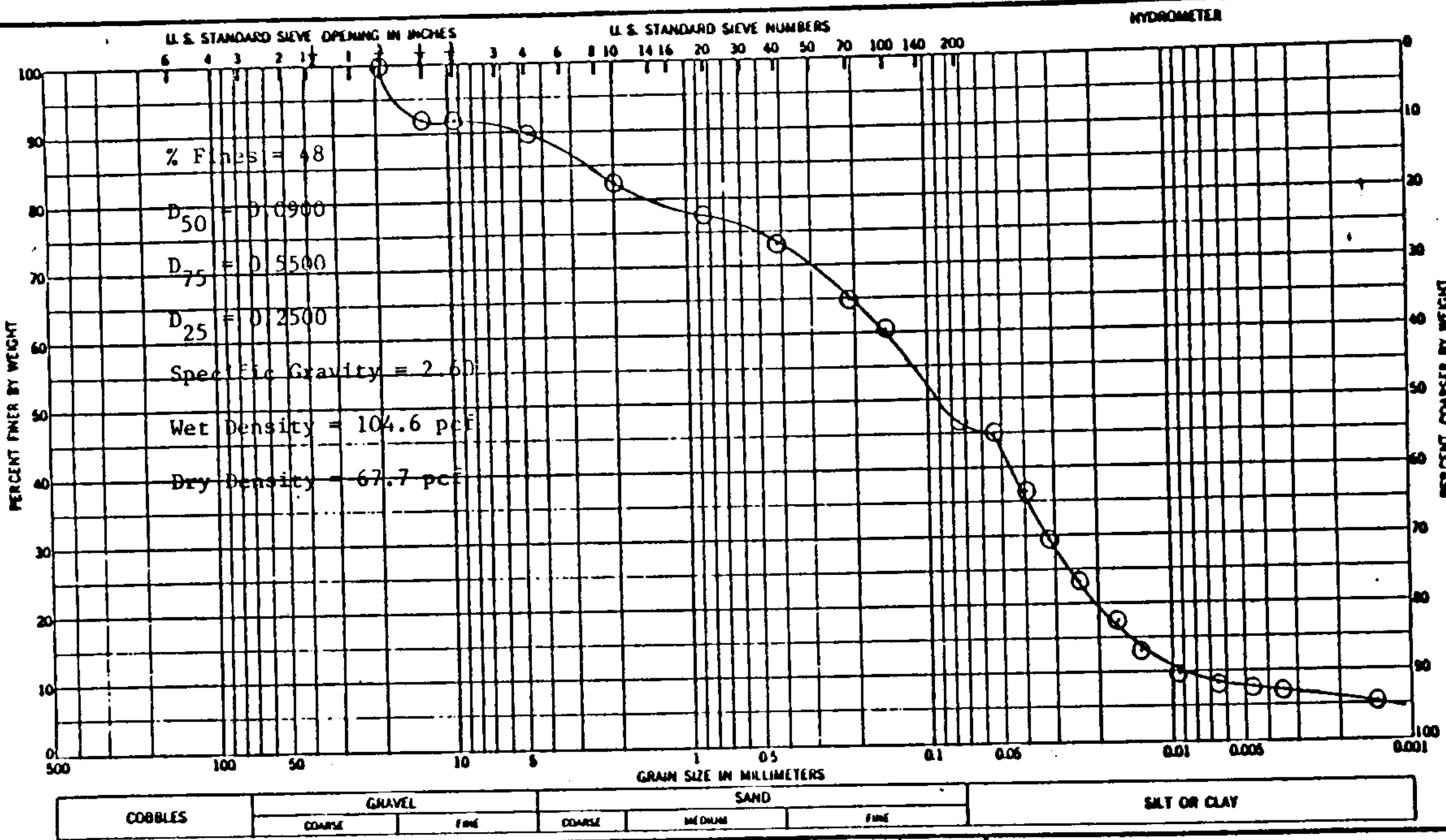
Date: August 1985

GRADATION CURVES

ENG FORM 1 MAY 63 2087

GPO 920-280

FIGURE 1-5K



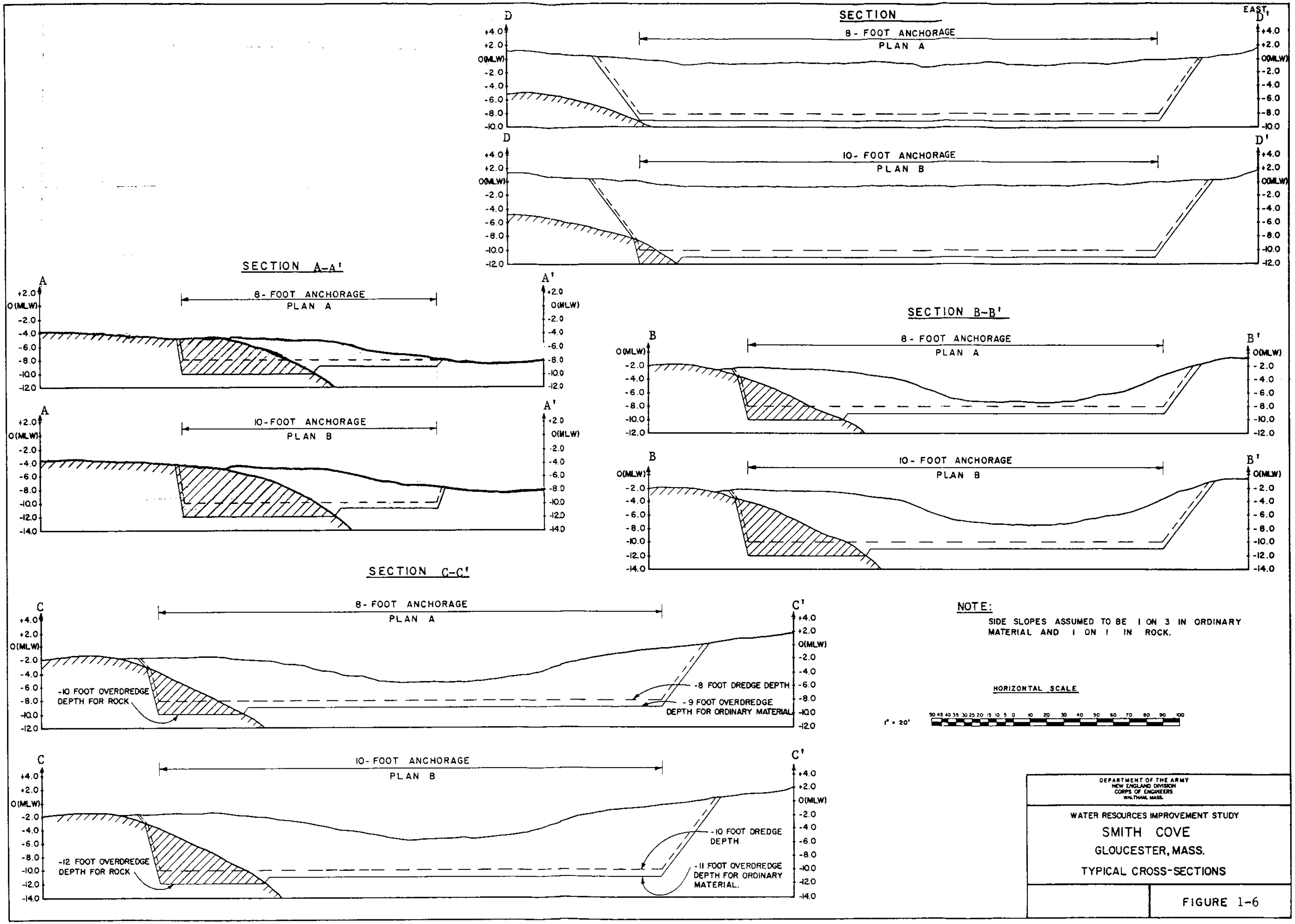
Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
Site-E2	0.0-1.0 ft	Black-olive gray organic silty, course to fine, sand (SM) with traces of gravel, shells, and organics.	54.6	61	33	28

GRADATION CURVES

Project: Smith Cove
Gloucester, Ma.
Area: Sediment Sieve Analysis
Boring No.: Site-E2
Date: August 1985

GPO 926-280

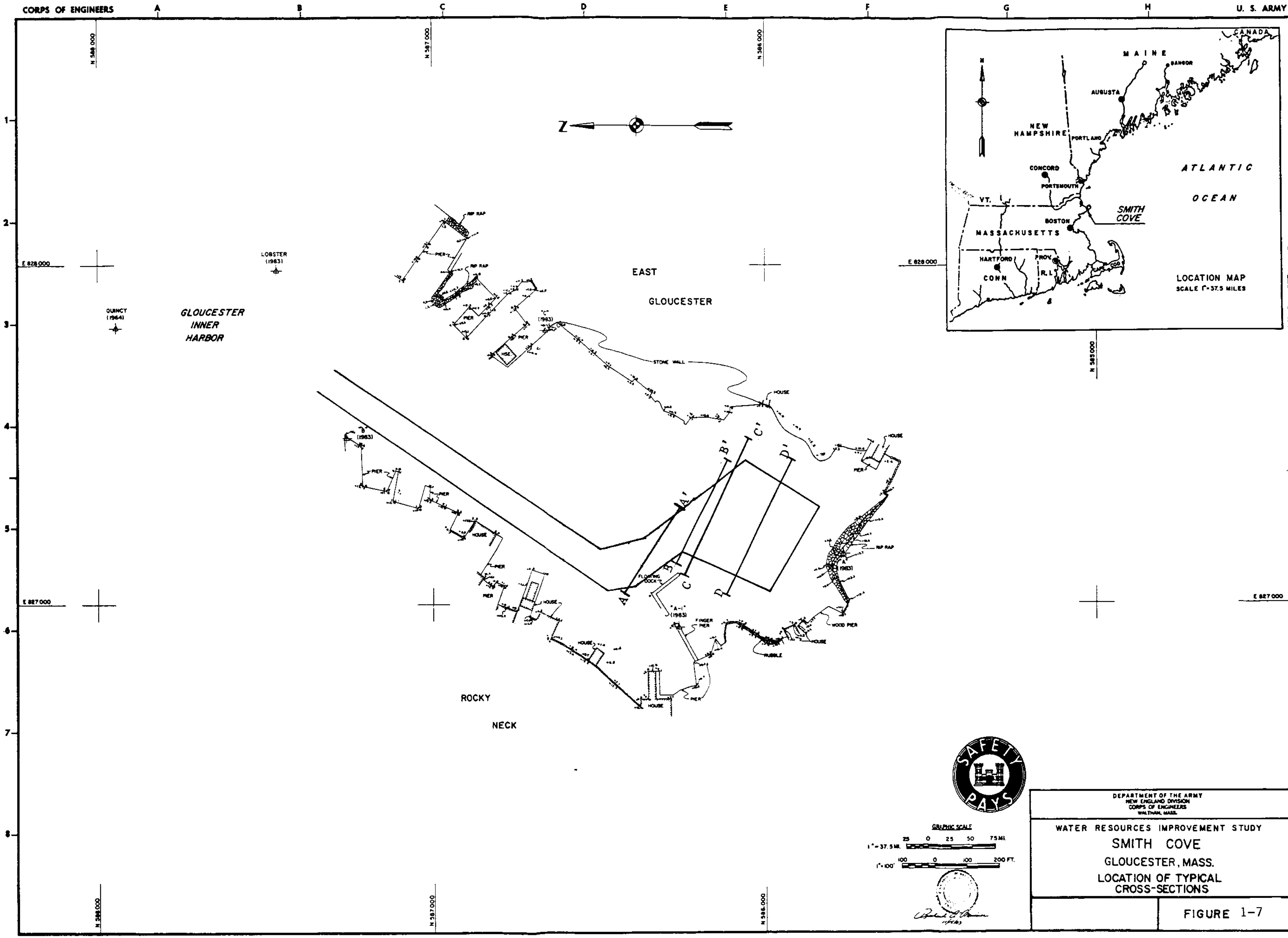
ENG FORM 1 MAY 63 2087

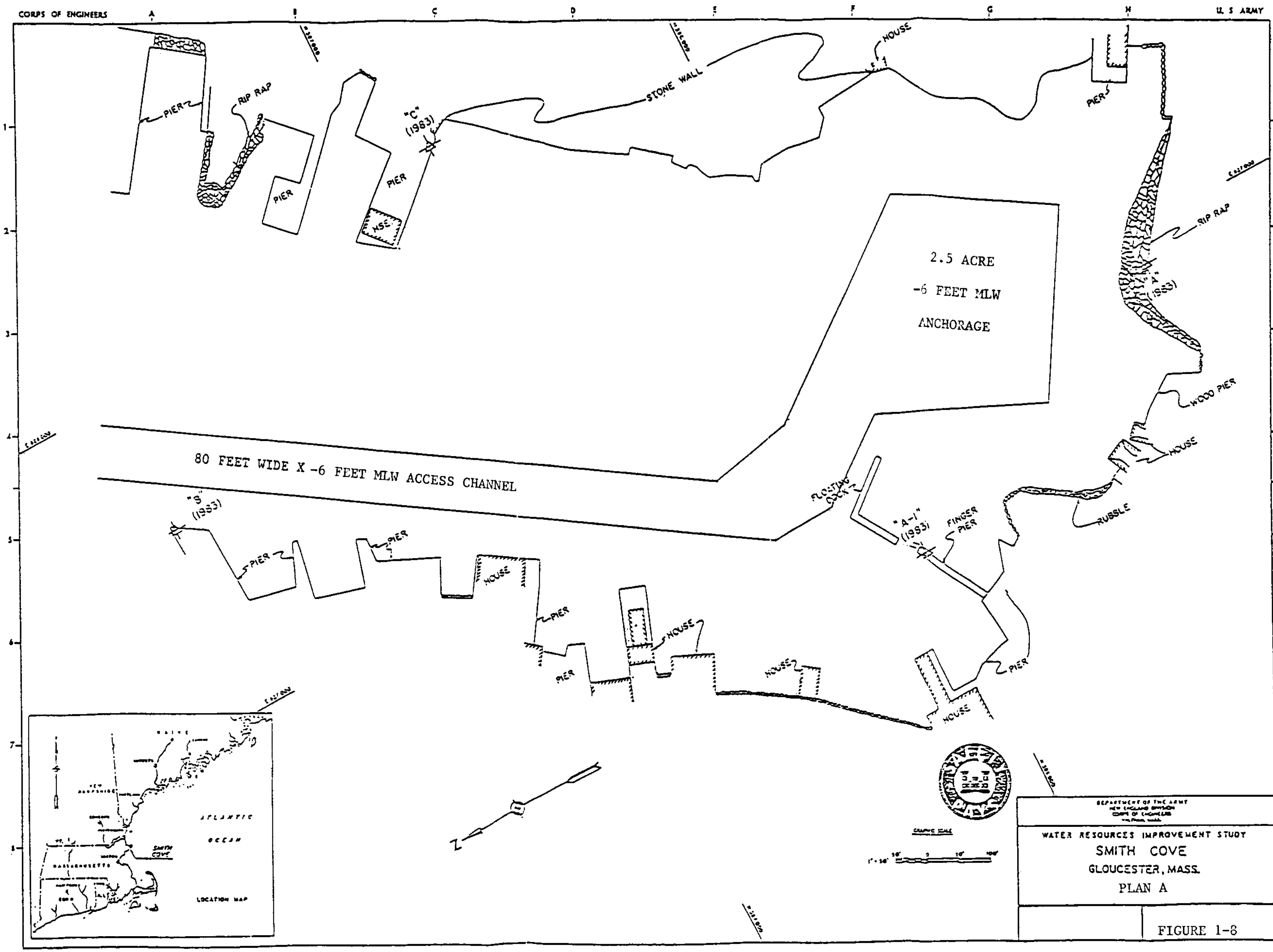


DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
TYPICAL CROSS-SECTIONS

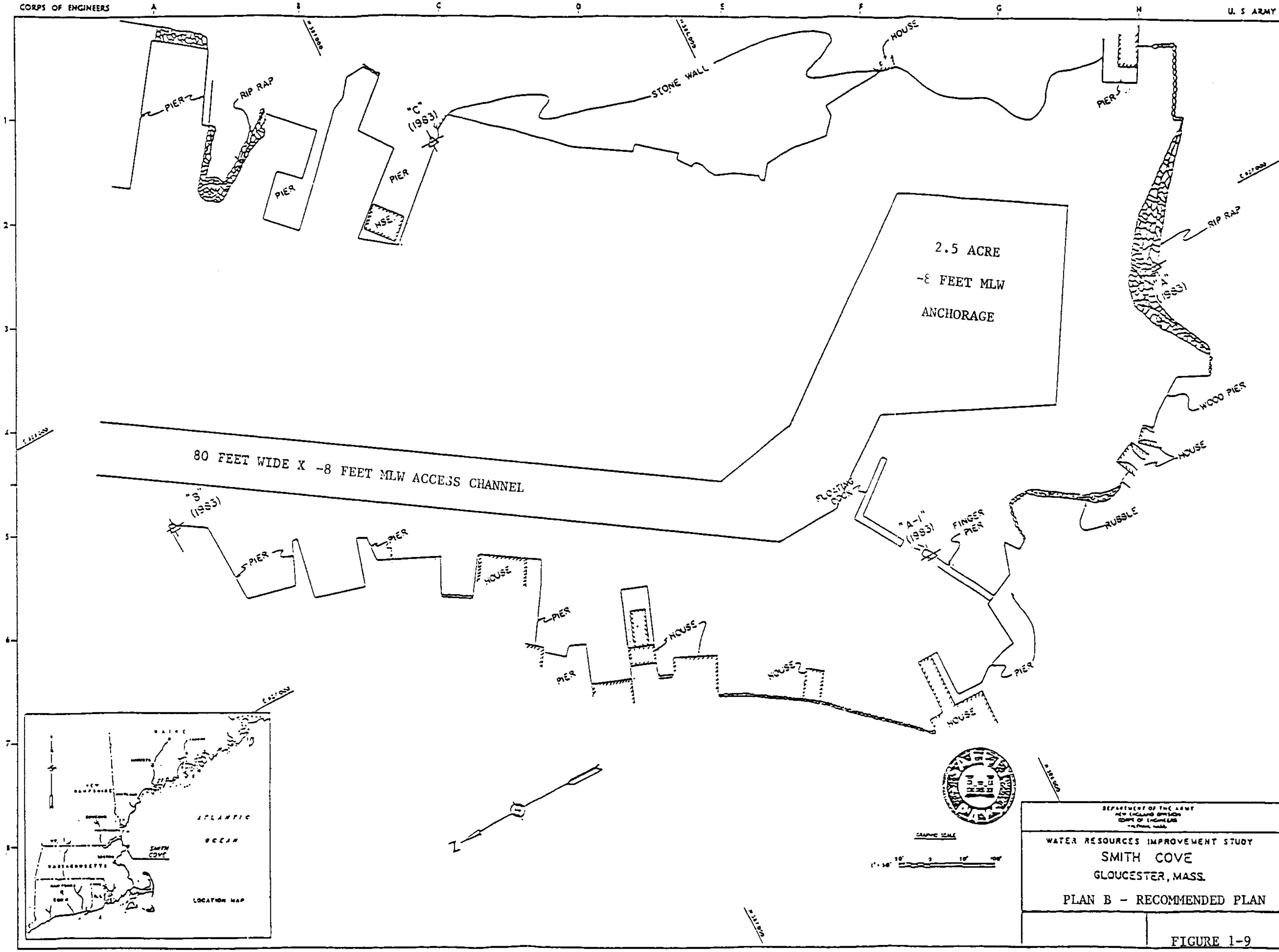
FIGURE 1-6


CORPS OF ENGINEERS
U. S. ARMY
GLOUCESTER
INNER
HARBOR
EAST
GLOUCESTER
ROCKY
NECK
LOCATION MAP
SCALE 1"=37.5 MILES
ATLANTIC
OCEAN
SMITH
COVE
MAINE
NEW
HAMPSHIRE
MASSACHUSETTS
BOSTON
CONN
R.I.
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
LOCATION OF TYPICAL
CROSS-SECTIONS
FIGURE 1-7



CORPS OF ENGINEERS
U. S. ARMY
PIER
RIP RAP
PIER
PIER
HSE.
"C" (1983)
STONE WALL
HOUSE
PIER
RIP RAP
"A" (1983)
2.5 ACRE
-6 FEET MLW
ANCHORAGE
WOOD PIER
HOUSE
RUBBLE
80 FEET WIDE X -6 FEET MLW ACCESS CHANNEL
"S" (1983)
PIER
PIER
HOUSE
PIER
HOUSE
PIER
HOUSE
FLOATING DOCK
"A-1" (1983)
FINGER PIER
PIER
HOUSE
ATLANTIC
OCEAN
SMITH COVE
LOCATION MAP
GRAPHIC SCALE
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
PLAN A

FIGURE 1-8



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS

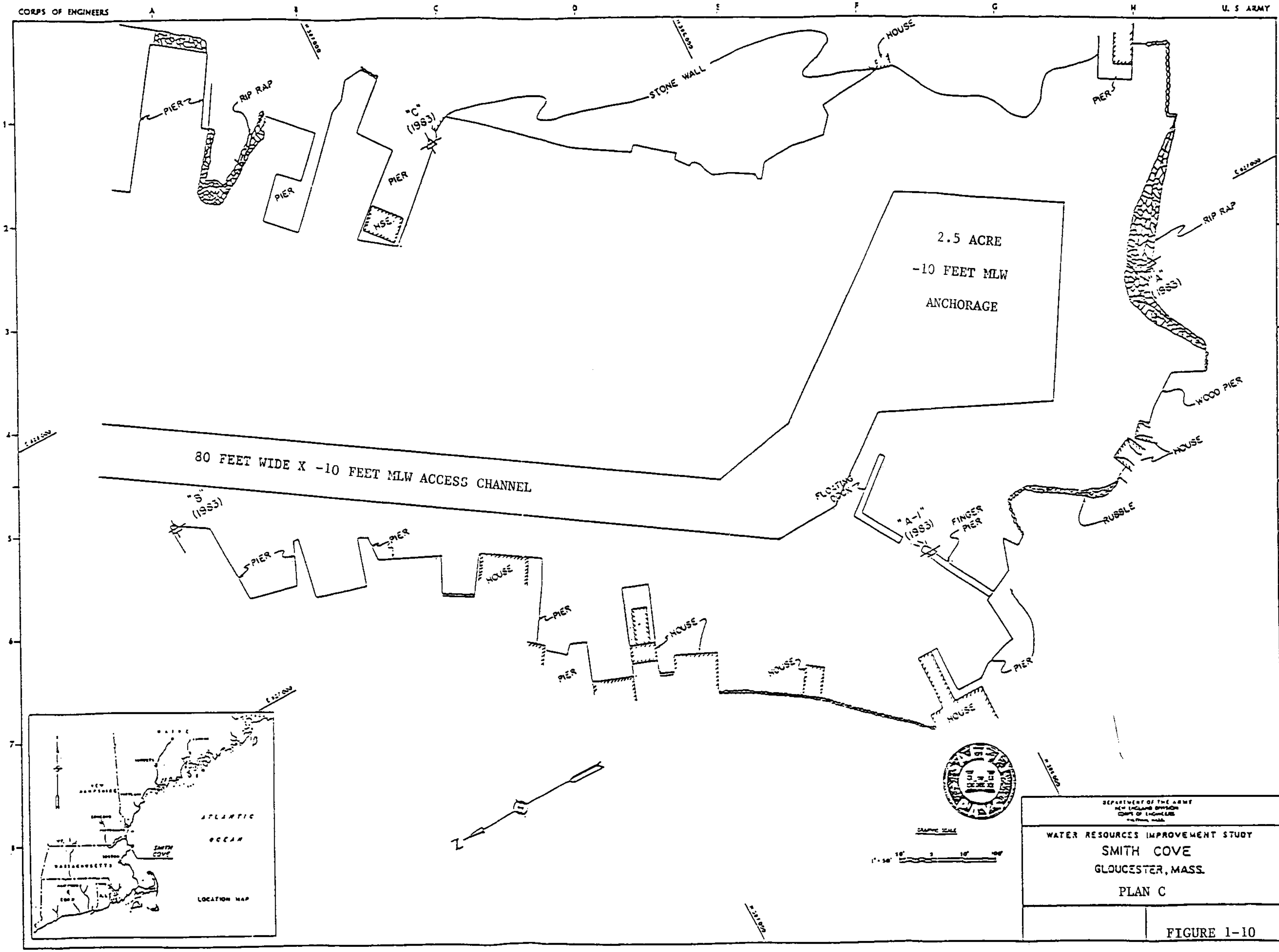
WATER RESOURCES IMPROVEMENT STUDY

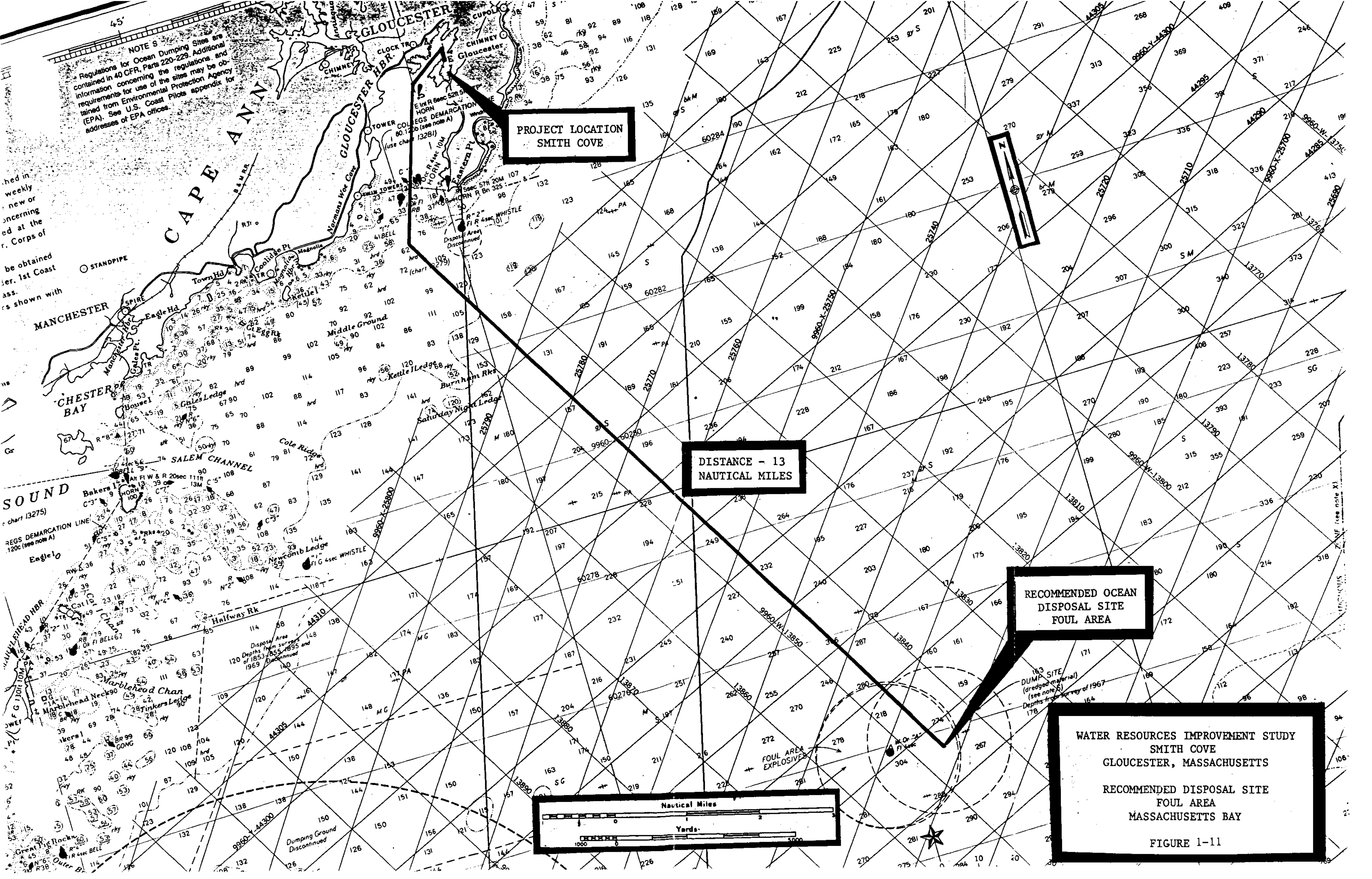
SMITH COVE

GLOUCESTER, MASS.

PLAN B - RECOMMENDED PLAN

FIGURE 1-9


CORPS OF ENGINEERS
U. S. ARMY
PIER
RIP RAP
PIER
PIER
HSE.
"C"
(1983)
STONE WALL
HOUSE
PIER
2.5 ACRE
-10 FEET MLW
ANCHORAGE
RIP RAP
WOOD PIER
HOUSE
RUBBLE
80 FEET WIDE X -10 FEET MLW ACCESS CHANNEL
"S"
(1983)
PIER
PIER
HOUSE
PIER
HOUSE
PIER
HOUSE
FLOATING DOCK
"A-1"
(1983)
FINGER PIER
PIER
HOUSE
ATLANTIC
OCEAN
SMITH COVE
LOCATION MAP
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASS.
PLAN C
FIGURE 1-10



WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

RECOMMENDED DISPOSAL SITE
FOUL AREA
MASSACHUSETTS BAY

FIGURE 1-11

WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE
GLOUCESTER, MASSACHUSETTS

SMALL NAVIGATIONAL PROJECT
DEFINITE PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

APPENDIX 2

SOCIAL AND ECONOMIC EFFECTS ASSESSMENT

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

APPENDIX 2
SOCIAL AND ECONOMIC EFFECTS ASSESSMENT

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Gloucester Harbor, Smith Cove,
Gloucester, Massachusetts
Social and Economic Effects Assessment

Introduction

This phase of the Gloucester Harbor Improvement Study is directed toward the social and economic features of the study area. The first section describes the socioeconomic characteristics of Gloucester, its population, employment, industry and land use. The second section discusses the economic and and social impacts with and without the project.

SECTION 1

Baseline Conditions

Population

The population in Gloucester grew rapidly between 1961 and 1970 but leveled off between 1970 and 1980. Over the period 1950 to 1980 population growth in Massachusetts and Essex County had been greater than that of Gloucester. Population figures for Gloucester, Essex County, and the Commonwealth of Massachusetts are presented in Table 2-1.

Economy

Employment in Gloucester reported to the Massachusetts Division of Employment Security in 1983 totaled 11,785. The manufacturing sector employs the largest percentage, 33.6, of these workers. The wholesale and retail trade sector employing 25.4 percent comes second and is followed by the services sector employing 15.9 percent. These data are presented in Table 2-2.

Land Use

Gloucester has a land area of approximately 27 square miles, or 17,000 acres. Forest comprises 56 percent of land use with urban/ residential use accounting for 25 percent. Residential/urban development has occured over the past 30 years at the expense of forest, agriculture and open land. Land use trends are shown in Table 2-3.

Table 2-1
Population, 1950-1980
Gloucester, Essex County Massachusetts

	Gloucester		Essex County		Massachusetts	
	Number	Percent Change from previous decade	Number	Percent Change from previous decade	Number	Present Change from previous decade
1950	25,167	-	522,384	-	4,690,514	-
1960	25,789	2.5	568,831	8.9	5,148,578	9.8
1970	27,941	8.3	637,887	12.1	5,689,170	10.5
1980	27,768	-0.6	633,632	-0.7	5,737,037	0.8

Source: Massachusetts Division of Employment Security

Table 2-2
Employment by Sector, 1983
Gloucester, Massachusetts

Sector	Number Employed	Percent of Total
Governmnet Public Ad.	974	8.3
Agrigulture, Forestry, Fisheries	876	7.4
Mining	-	-
Construction	314	2.7
Manufacturing	3,958	33.6
Transportation, Communication, Utilities	504	4.3
Wholesale & Retail Trade	2,990	25.4
Finance, Insurance, Real Estate	296	2.5
Services	1,873	15.9
TOTAL	11,785	

Source: Massachusetts Division of Employment Security

Table 2-3
City of Gloucester Land Use

Land Use Type	Acres		
	1951	1971	1980
Forest	11,407	9,666	9,548
Agriculture/Open Land	1,145	402	381
Wetland	1,333	1,091	1,080
Water	252	1,263	1,263
Mining/Waste Disposal	NC	154	119
Urban/Residential	2,836	4,075	4,260
Outdoor Recreation	NC	322	322
TOTAL	16,973	16,973	16,973

SOURCE: Gloucester Planning Office
NC - Not Classified

Without Project Condition

No Federal Improvement Option

Due to onshore economic development, nine commercial fishing boats would be displaced from their present moorings in Gloucester Inner Harbor. Discussions with city officials determined that no replacement mooring space is available within the harbor. These commercial operators would be forced to move their moorings to nearby harbors in Beverly or Ipswich, Massachusetts.

The fishermen stated that even if forced to move their moorings, they would continue to conduct business out of Gloucester due to the lack of onshore support facilities at the other ports. Without the proposed Federal navigation improvement, approximately 2-1/2 to 3 hours to transit time would be added to their existing operation. This would result in increased operating costs associated with increased transit distances to home ports.

With Project Conditions

Impacts During Construction

The proposed alternative Federal plans of improvement provide for an access channel 80 feet wide from the existing 16-foot MLW Federal channel at the north end of Smith Cove, to a proposed 25 acre anchorage at the south end. Alternative depths of 6, 8, and 10 feet at MLW were anlayzed in detail.

Impacts would be felt in the harbor area during the construction phase. These impacts, related to the actual construction activities, include increased air pollutants, noise and dust levels, temporary employment, and road and harbor traffic.

Construction related effects generally are short term and site specific. The construction period would not exceed three months. Ten to 30 people would be temporarily employed as a direct result of project implementation.

Dredging would be performed by a bucket dredge. A dredge plant, drill rig, at least two barges, and a tug would be used to construct the project. The presence of barges hinder normal traffic flow within the harbor area. This increase in harbor vessels would temporarily increase the safety hazards and accident risks faced by boaters.

Disposal of the dredged material is discussed in the environmental section of the report. Since ocean disposal is proposed, impacts would be restricted to the movement of materials from the harbor to the ocean site. Disposal at the selected site would not interfere with fishing activities.

Impacts After Construction

Post-construction impacts generally are long term and can have both site specific and regional implications. Social and economic issues addressed in this section not only include the particular output of the plan (e.g., increased anchorage) but also describe the impacts of this output on the town and region.

Implementation of the Corps' project would increase the operating efficiency of the Gloucester fleet. The same quantity of fish could be caught for a lower cost. The overall impact on the city and region would not be significant.

Social Well-Being Contributions

Effects on Health, Safety, Community Well-Being

The project alternatives would have both adverse and benefical effects on the health, safety, and community well-being of Gloucester Harbor. Adverse effects would be temporary and occur during the construction phase. The presence of barges and the movement of construction materials within the project area would be an additional health and safety risk to harbor users.

During dredging two barges would be positioned side-by-side, one transporting the dredge and the other being loaded with dredged material. Blasting activities would also occur. These would be restricted to times of minimal harbor use and would temporarily limit channel use. The dredging operation would also increase the safety hazards and accident risk during its presence in the harbor. Nevertheless, the fishermen would gladly accept the temporary inconveniences for the needed improvements.

The long-term effects of the structural plan are generally positive contributions to the health, safety and community well-being of Gloucester harbor.

SECTION 2

Methodology

The purpose of this section is to present the economic benefits resulting from proposed improvements in Smith Cove. Benefits are of the commercial fishing type. All benefits and costs are at an October 1988 price level. Costs and benefits are converted to an average annual equivanlent basis using the current Federal interest rate of 8 7/8%.

Existing Condition

Gloucester Harbor is currently used for both commercial fishing and recreational boating purposes. The inner harbor consists of an area of about 52 acres and contains two coves, Harbor Cove and Smith Cove.

The inner harbor contains 8 marinas with a total 230 of boats at slips or moorings. The commercial fleet numbers approximately 160 vessels. Docking spaces for commercial boats within the harbor is limited. Rafting is used extensively within the harbor to accomodate the existing commercial fleet.

Commericial fishery landings in 1983 where 150,900,000 pounds at a value of $38,000,000 which ranks the port of Gloucester seventh and eighth nationally in poundage and value, respectively. Fishing provides the city with 40 percent of its jobs and revenue.

The main problem in Gloucester harbor is that harbor economic development has displaced nine fishing boats. As all available space in the harbor is taken, these boats will be forced to leave the harbor for nearby ports. The closest nearby ports being in Beverly and Ipswich, Massachusetts. These fishermen will still sell their catch to the same sources, but will incur additional operating costs as they travel an extra three hours a day in order to berth their boats.

Species Harvest

The Gloucester fleet catches mainly groundfish and lobster. The more important species caught in terms of volume in 1983 were cod, flounder, haddock, sea herring, whiting, pollock and sea scallops. Lobster, although not caught in large volumes, has a high value. The fishing grounds for finfish are Georges Bank and Brown Bank. The Gloucester harvest for 1983 is presented in Table 2-4.

The ground fish catch for the entire New England fleet using otter trawl gear is displayed in Table 2-5. Economic indices for the New England groundfish fishery are also displayed in this table. These indices were developed by the National Marine Fisheries Service (NMFS). The number of vessels in this fishery increased approximately 90 percent from 512 to 975 for the period 1965 to 1982. Concurrently, landings declined approximately 33 percent from 243,000 metric tons (mt) to 161,000. Thus, catch per vessel declined from 475 mt (1,064,000 lbs.) in 1965 to 176 mt (394,240 lbs.) in 1981. The value of landing increased 253 percent from $36,560,000 to $128,956,00. Adjusted for inflation this increase is only approximately 34 percent.

The effort index (vessel days absent) increased approximately 30 percent from 1965 to 1982. Thus, catch per unit of effort is declining. Further, the revenue and cost data in Table 2-5 indicates that profits in this fishery declined between 1965 and 1981.

Profits however while on the decline are still positive in the New England groundfish industry as evidenced by the net increased entry of new fishing boats. Since profits overall continue to be positive the finfish industry should continue to expand.

Table 2-4
1983 GLOUCESTER LANDINGS (METRIC TONS) BY SPECIES

SPECIES	METRIC TONS
Cod	14986.9
Haddock	8321.0
Redfish	2511.7
Halibut	40.8
Sil Hake	3088.0
Amer Plaice	4435.7
Summer Fl	117.6
Winter Fl	408.1
Witch Fl	980.8
Yellowtail	1001.8
Flounder Nk	38.3
Pollock	5112.3
Red Hake	597.1
Wh Hake	1418.0
Sea Herr	6664.7
Mackerel	163.7
Menhaden	10468.9
Sea Scal	4888.0
Lobster	36.9
Shrimp	658.5
Other	4892.4
TOTAL	70831.3

Source: National Marine Fisheries

Table 2-5

Indices of cost, prise and effort for the New England otter trawl fishery.

Year	Number of Vessels[1]	Output cost index (cost/unit of landings)	Input price index	Average ex-vessel price index	Effort Index (vessel days absent)	Landings (000's mt)
1965	512	100.00	100.00	100.00	100.00	243
1966	545	106.56	104.20	110.82	97.22	231
1967	559	119.93	105.90	107.13	97.40	209
1968	538	118.52	109.50	110.42	90.42	203
1969	550	134.13	115.60	134.33	88.81	186
1970	562	159.11	119.40	160.17	94.33	172
1971	566	167.07	118.80	164.74	89.70	155
1972	565	196.72	121.40	207.34	90.02	135
1973	553	210.39	135.20	228.75	85.81	134
1974	575	291.47	166.60	261.05	88.56	123
1975	587	355.96	177.20	331.04	95.07	115
1976	590	347.71	184.80	364.41	91.37	118
1977	594	313.61	196.00	368.92	88.89	135
1978	643	345.75	214.30	424.40	96.27	145
1979	768	425.31	246.10	464.53	108.81	153
1980	896	500.39	287.60	464.20	118.86	166
1981	914	551.57	321.90	532.38	113.53	161
1982	975	596.67	319.80	594.81	129.76	

Source: Status of the Fishery Resources Off the Northeastern United States for 1983.

1 Excludes vessels <5 gross register tons.

Catch data for the inshore lobster fishery are presented in Tables 2-6 and 2-7 for the State of Massachusetts and Essex County includes Gloucester.

An examination of data in Table 2-6 and 2-7 indicate that the number of commercial lobster fishermen increased by 31 percent between 1969 and 1982, while catch increased by 247 percent, and effort increased by 148 percent. Since the industry is expanding it may be presumed that profits are positive for the Massachusetts lobster fishery. As catch per unit of effort is increasing it may well be the case that profits are not only positive, but are not declining as in the New England ground fish fishery.

The data in Tables 2-6 and 2-7 must be interpreted with caution due to inaccuracies in reporting by the fishermen. Officials at the Massachusetts Division of Marine Fisheries indicate a greater drgree of confidence in data provided since 1980 due to quality control measures implemented at that time.

Since 1980, catch effort and number of fishermen have continued to increase. Catch per unit of effort (traps) has remained about the same since 1980. Overall it appears that the lobster industry can be expected to continue to expand.

Table 2-6
MASSACHUSETTS LOBSTER FISHERY
STATISTICS

Year	Catch (lbs.)	Ex-Vessel[1] price (lbs.)	Effort (No. Traps)	C/E	Number Fishermen[2]
1969	3,598,929	.99	141,526	25.4	1190
1970	3,780,776	1.08	152,260	24.8	1370
1971	1,843,180	1.16	162,276	23.7	1034
1972	4,222,097	1.23	175,573	24.0	1144
1973	3,680,554	1.49	169,749	21.7	1053
1974	3,882,535	1.50	156,987	24.4	982
1975	5,203,315	1.80	213,468	24.4	1256
1976	4,207,278	1.73	240,935	17.5	1311
1977	5,765,530	1.87	236,796	24.3	1272
1978	7,028,598	1.89	257,458	27.3	1424
1979	7,627,262	2.00	291,540	26.2	1470
1980	9,904,199	2.14	283,653	34.9	1535
1981	10,893,769	2.09	310,918	35.0	1545
1982	11,152,564	2.28	331,658	33.6	1559
1983	12,503,824	-	350,567	35.7	-

[1] Based upon Fishermens Annual report 1969-1979, Massachusetts Dealer Transaction Program 1980, and National Marine Fisheries "Blue Sheet" 1981-1982.

[2] Number of licensed fishermen that reported "fishing".

Source: Massachusetts Division of Marine Fisheries.

Table 2-7
LOBSTER CATCH
ESSEX COUNTY

Year	Catch (lbs.)	Effort (No. Traps)	C/E
1969	1,278,919	48,109	26.6
1970	1,362,253	55,980	24.3
1971	1,249,895	52,508	23.8
1972	1,469,919	58,387	25.2
1973	1,409,717	52,852	26.7
1974	1,532,231	59,231	25.9
1975	2,013,034	81,852	24.6
1976	2,027,860	90,149	22.5
1977	2,398,109	91,344	26.3
1978	2,899,970	100,740	28.8
1979	3,174,866	114,628	27.7
1980	3,589,061	115,447	31.1
1981	4,124,759	123,231	33.5
1982	3,914,021	126,440	31.0

Source: Massachusetts Division of Marine Fisheries

Resource Status

Catch data for the major species caught by the Gloucester fleet are presented in table 2-8 through 2-14. In only two species, cod and lobster, is the long term potential catch less than current levels. The long term potential catch is basically the same as the maximum sustainable yield. Harvest rates greater than this may deplete the fish population eventually to zero. Annual catch levels running above the long run potential may eventually increase costs to the extent that some boats will have to leave the industry.

These tables also contain information on the status of fishery management plans. These plans are discussed later in the report. These tables are reproduced in part from tables appearing in the "Status of the Fishery Resources off the Northeastern United States for 1983" produced by the National Marine Fisheries Service.

Thus, with the exception of cod and lobster, current levels of catch off the New England coast do not pose any serious threat to the long run profitability of the New England fishing fleet.

Table 2-8

Nominal catches (thousand metric tons) and management information for Atlantic cod from Georges Bank and South, 1971-1983

Category	1971-1975 Average	1976	1977	1978	1979	1980	1981	1982	1983
	Year								
USA recreational	-	-	-	-	3.1	-	-	-	-
Commercial									
USA	16.0	14.9	21.1	26.6	32.6	40.0	33.9	39.3	36.8
Canada	2.4	2.3	6.2	8.9	6.0	8.1	8.5	17.9	12.1
Other	8.5	2.7	0.1	-	-	-	-	-	-
Total Nominal catch	26.9	19.9	27.4	35.5	41.7	48.1	42.4	57.2	48.9
Total Allowable catch	-	35.0	26.7	26.0	36.9	35.0	35.0	-	-

Long-term potential catch	=35.0
Importance of recreational fishery	=Major
Status of management	=FMP in force since March 1977
Status of exploitation	=Fully exploited

Source: Status of the Fishery Resources off the Northeastern United States for 1983.

Table 2-9
Nominal catches (thousand metric tons) and management information for Georges Bank haddock, 1971-1983

Category	Year 1971-1975 Average	1976	1977	1978	1979	1980	1981	1982	1983
USA recreational	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Commercial									
USA	4.1	2.9	7.9	12.2	14.3	17.5	19.2	12.6	8.7
Canada	1.1	1.4	2.9	10.2	5.2	10.1	5.7	5.6	3.2
Other	1.1	<0.1	-	-	-	-	<1	-	-
Total Nominal catch	6.3	4.4	10.8	22.4	19.5	27.6	24.9	18.2	11.9
Total Allowable catch	-	6.0	10.5	19.0	22.1	22.9	22.9	-	-

Long-term potential catch	=47.0
Importance of recreational fishery	=Insignificant
Status of management	=(Interim) FMP in force since 31 March 1982
Status of exploitation	=Fully exploited

Source: Status of the Fishery Resources off the Northeastern United States for 1983.

Table 2-10
Nominal catches (thousand metric tons) and management information for silver hake (whiting) from Georges Bank, 1971-1983

Category	Year 1971-1975 Average	1976	1977	1978	1979	1980	1981	1982	1983
USA recreational	-	-	-	-	-	-	-	-	-
Commercial									
USA	3.3	3.8	3.7	6.4	0.9	1.2	1.2	3.0	1.1
Canada	-	-	-	-	-	-	-	-	-
Other	64.9	42.0	40.6	3.6	1.0	0.5	0.3	0.1	0.1
Total Nominal catch	68.2	45.8	44.3	10.0	1.9	1.7	1.5	3.1	1.2
Total Allowable catch	-	50.0	70.0	58.8	58.8	35.0	25.0	25.0	25.0

Long-term potential catch =80.0
Importance of recreational fishery =Insignificant
Status of management =FMP in force since 1977
Status of exploitation =Underexploited

Source: Status of the Fishery Resources off the Northeastern United States for 1983.

Table 2-11
Nominal catches (thousand metric tons) and management information for redfish, (ocean perch) from the Gulf of Maine and Georges Bank area, 1971-1983

Category	Year								
	1971-1975 Average	1976	1977	1978	1979	1980	1981	1982	1983
USA recreational	-	-	-	-	-	-	-	-	-
Commercial									
USA	3.9	0.7	0.4	2.1	1.1	1.7	0.7	1.0	0.1
Canada	3.6	-	-	-	-	-	-	-	-
Other	180.4	42.8	1.8	-	-	-	-	-	-
Total Nominal catch	187.8	43.5	2.2	2.1	1.1	1.7	0.7	1.0	0.1
Total Allowable catch	-	60.0	33.0	8.0	15.0	15.0	15.0	-	-

Long-term potential catch =100.0
Importance of recreational fishery =Insignificant
Status of management =FMP withdrawn in 1982
Status of exploitation =Not exploited

Table 2-12

Nominal catches (thousand metric tons) and management information for pollock from the Gulf of Maine, Georges Bank, and Scotian Shelf area, 1971-1983.

Category	Year								
	1971-1975 Average	1976	1977	1978	1979	1980	1981	1982	1983
USA recreational	1.6	0.6	2.7	1.8	1.8	2.1	2.3	2.0	2.0
Commercial									
USA	7.0	10.9	13.1	17.7	15.5	18.3	18.2	14.4	14.0
Canada	21.7	23.6	24.7	26.8	30.0	36.0	40.3	38.0	35.0
Other	7.5	3.2	0.7	0.8	1.1	1.2	0.5	0.4	-
Total Nominal catch	37.8	38.3	41.2	47.1	48.4	57.6	61.2	54.8	51.0
Total Allowable catch	-	55.0	30.0	-	-	-	-	-	-

Long-term potential catch	=56.0
Importance of recreational fishery	=Minor
Status of management	=FMP in preparation (USA fishery)
Status of exploitation	=Fully exploited

Table 2-13

Nominal catches (thousand metric tons) and management information for Georges Bank flounder[1], 1971-1983

Category	Year								
	1971-1975 Average	1976	1977	1978	1979	1980	1981	1982	1983
Commercial									
USA	45.9	28.3	45.4	44.7	56.7	63.9	56.9	70.2	79.1
Canada	-	-	-	0.2	-	-	-	-	-
Other	4.9	-	0.2	-	0.1	-	-	-	-
Total Nominal catch	50.8	28.3	45.6	44.9	56.8	63.9	56.9	70.2	79.1
Total Allowable catch	-	20.0	16.0	8.1	8.5	10.0	10.0	-	-

Long-term potential catch	=54.0[2]
Status of management	=Interim FMP in effect since 31 March 1982[2]
Status of exploitation	=Fully exploited

1 Includes yellowtail, summer, dabs, witch and winter.

2 Yellowtail and summer flounder only

Table 2-14

Commercial and recreational landings (metric tons, live weight) of American lobster from Gulf of Maine - Mid-Atantic area, 1971-1983

Category		Year									
		1971-1975 Average	1976	1977	1978	1979	1980	1981	1982	1983	
USA recreational											
State waters		-	-	-	-	-	-	-	-	-	
Commercial											
USA:	Offshore	3.8	3.9	3.0	3.3	2.5	2.2	1.8	2.2	2.5	
	Inshore	10.1	10.5	11.4	12.4	15.0	15.3	15.8	15.7	17.5	
Canada:	Georges Bank		0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.3
	Other	-	-	-	-	-	-	-	-	-	
Total Nominal catch		14.1	14.6	14.7	16.0	17.7	17.7	17.8	18.2	20.3	
Total Allowable catch		-	-	-	-	-	-	-	-	-	

Long-term potential catch =3.4
Importance of recreational fishery =Insignificant
Status of management =FMP in preparation
Status of exploitation =Fully exploited

Fishery Regulation

The inshore lobster fishery is regulated by the Commonwealth of Massachusetts (0-3 miles from the coast), while fish catch between 3 and 200 miles is regulated by the Federal Government. Federal regulation is effected through fishery management councils who issue fishery management plans (FMP) that regulate catch, gear size and minimum fish size. The New England Fishery Management Council lifted quotas on most finfish in 1982. The current FMP regulates mesh size and minimum fish size.

Massachusetts began to regulate entry to lobstering in 1975 when it instituted a license moratorium. Under this system, only those licenses retired to the Commonwealth were reissued through an annual lottery. In 1979, the State legislature mandated the Division of Marine Fisheries to develop another system or go back to open entry. An attempt was made to limit the number of traps per lobsterman, but this was met with strong opposition and eventually dropped. The system that evolved requires that 100 new licenses be issued each year. Prior to 1979, this magnitude approximated the number of licenses that were retired annually. However, this new system allows lobster licenses to be transferred. A standard procedure for persons wanting to enter into lobsterring is for them to set up a corporation or partnership with someone who has a license, work with him for a year, dissolve the partnership, sign a statement that he has followed this procedure, and he receives the license.

This, the transfer system is phasing out control on effort. One hundred licenses are being issued each year and none are being retired.

It does not appear that current regulations will have any effect upon the proposed plan.

Market for Fish

As can be seen in Table 2-15, the demand for fish fillets and steaks for the entire United States has increased approximately 77 percent from 1.62 lbs. per capita to 2.86 for the period 1964 to 1983. These data include groundfish and other species.

As can be seen in Table 2-16, the U.S. supply of groundfish fillets and steaks has increased from 210,688,000 lbs. in 1974 to 377,982,000 lbs. in 1983, or approximately 80 percent. Approximately 80 percent of this supply was imported over this period. Although imports as a percentage of total U.S. supply have increased in prior years, this percentage appears to have levelled off.

The market for fish has two segments - fresh and frozen. The New England fresh fish market extends as far south as Louisville, Kentucky and as far west as Chicago. New England fishermen mainly supply the fresh fish market where as the frozen market is primarily supplied by foreign sources.

TABLE 2-15
U.S. ANNUAL PER CAPITA CONSUMPTION OF FILLETS AND STEAKS[1], 1964-83

YEAR	POUNDS PER CAPITA
1964	1.62
1965	1.68
1966	1.74
1967	1.64
1968	1.86
1969	2.01
1970	2.17
1971	2.04
1972	2.27
1973	2.52
1974	2.12
1975	2.39
1976	2.52
1977	2.52
1978	2.67
1979	2.66
1980	2.63
1981	2.74
1982	2.68
1983	2.86

(1) Data include groundfish and other species. Data do not include blocks, but fillets could be made into blocks from which sticks and portions could be produced.

Note: From 1970 through 1980, data were revised to reflect the results of the 1980 census.

Source: Fisheries of the United States, 1983

TABLE 2-16
U.S. SUPPLY OF GROUNDFISH FILLETS AND STEAKS, 1974-83
(Edible Weight)

Year	U.S. production (1) Quantity	U.S. production (1) Percentage of total supply	Imports Quantity	Imports Percentage of total supply	Total Supply Quantity
	Thousand pounds	Percent	Thousand pounds	Percent	Thousand pounds
1974.......	45,337	21.5	165,351	78.5	210,668
1975.......	36,822	15.5	200,356	84.5	237,178
1976.......	40,564	15.1	228,287	84.9	268,851
1977.......	59,942	21.6	217,423	78.4	277,365
1978.......	65,573	22.0	233,106	78.0	298,679
1979.......	74,658	22.8	252,957	77.2	327,525
1980.......	67,221	23.3	220,954	76.7	288,175
1981.......	77,092	23.1	257,164	76.9	334,256
1982.......	70,994	19.4	295,193	80.6	366,187
1983.......	79,812	21.1	*298,170	78.9	*377,982

(1) Includes fillets used to produce blocks. Species include: cod, cusk, haddock, hake, Atlantic pollock, and Atlantic ocean perch. *Record. Record-1951 U.S. production: 148,786,000 lbs.

Source: Fisheries of the United States, 1983

In New England, there was a total of 221 processing plants and 282 wholesale establishments in 1982. Massachusetts had 107, or approximately 38 percent of the processing plants and 96, or approximately 34 percent of the wholesale establishments. The number of processors and wholesalers declined approximately 10 percent from 1957 to 1972, going from 554 to 500. Thus, this number has remained stable over the past ten years.

Gloucester is one of the largest fishing ports in the United States. It has approximately 75 piers and wharves, 90 percent of which are used in some connection with the fishing industry. Of these, 32 with a total frontage of about 6,600 feet, are considered commercially important. All are located within the Inner Harbor. Nine fish purchasing firms have a total daily freezing capacity of over 500 tons and a total cold storage capacity of 15,800 tons. Construction is currently underway for a new processing plant as part of the Head of the Harbor development project. Plans for the project call for 3 more fresh fish processing plants.

In summary, the demand for fish has been steadily increasing. Since the late 1940's the imported share of total US supply has been increasing, leveling off in the early 1970's at about 80 percent. The increase in imported fish occurred because of a lower ex-vessel price and the introduction of fish sticks which primarily use frozen fish. However, the decline in the growth rate of fishing activity appears to have stopped in New England. The number of boats fishing and landings have increased since 1977. The number of processing plants and wholesalers has remained constant since 1972.

Without Project Condition

Onshore harbor development is displacing existing mooring space for some commercial fishing vessels. No replacement mooring space is available within the harbor. Without the proposed navigation improvement project these boats would be forced to transfer to nearby ports. These commercial fishermen would continue to operate out of Gloucester Harbor due to a lack of onshore support facilities elsewhere. This would result in increased operating costs as travel time is increased.

With Project Condition

Corps proposed navigation improvement alternatives call for dredging an 80 foot wide, 750 foot long access channel from an existing Federal channel at the north end of Smith Cove to a proposed 2.5 acre anchorage at the south end. Depths of -6, -8 and -10 feet mean low water (mlw) were analyzed for both the access channel and anchorage. Based on the characteristics of the boats to moor in Smith Cove, dredging the proposed project to -8 feet mlw is recommended.

Navigation improvements considered in Smith Cove will have no effect upon species harvest rates. These alternatives will, however, affect harvesting costs. Without a project nine fishing boats, which catch primarily groundfish and lobster, will be displaced from Gloucester Harbor. These boats were previously docked in the area adjoining the Gloucester House Restaurant and have been displaced by recent development. These boats are temporarily docked in the North Channel at the Head of the Harbor project. However, this space will not be available when the project is completed.

The number and type of boats displaced are presented in Table 2-17.

TABLE 2-17
Displaced Boats,
Gloucester Harbor

GEAR	SIZE	NO.
Lobster	33'	1
	35'	2
	39'	1
Gill netters	35'	1
	47'	1
	55'	1
Scottish Seiner	37'	1
Dragger	55'	1
	TOTAL	9

The nearest available ports are in Beverly and Ipswich, Massachusetts. Beverly would require an additional daily 2 1/2 hours of transit time and Ipswich 3 hours.

These boats do not fish in Georges Bank. The fishing grounds utilized by lobster boats are 3 to 4 miles offshore while the groundfish boats fish 25 to 30 miles offshore. Although these boats do not fish Georges Bank, the status of the resource there is indicative of all New England fishing grounds.

Operational Cost Savings

Benefits for providing the channel and anchorage area are operational cost savings to the nine boats which, in the without project condition, would be displaced to other harbors. The nearest available ports to which they would be displaced are in Beverly and Ipswich, Massachusetts. Displacement to Beverly would require additional transit time of 2-1/2 hours per day, and displacement to Ipswich would require additional transit time of three hours per day. Increased transit time results in higher operational costs. Both labor and fuel inputs will need to be increased to produce the same amount of fish catch. Operational savings will vary depending upon the size of the boat. The valuation of inputs by boat size is presented in Table 2-18.

For the proposed plan of dredging to -10 feet, channel and anchorage depth would be sufficient to easily accommodate all nine boats listed in table 2-17. For the proposed plan of dredging to -8 feet, this analysis assumes that all nine boats would use the channel and anchorage area, but the 55 foot dragger Gill netter would experience some tidal delays and grounding damages. For the proposed plan of dredging to -6 feet, this analysis assumes that the channel and anchorage area would be too shallow for the two 55 foot boats, and so these two boats would also be displaced to other harbors as in the without project condition. Also, with the dredge to -6 feet plan, the 47 foot gill netter would experience some tidal delays and grounding damages.

Based on data provided by fishermen in Gloucester and other harbors, it was estimated for the analysis of the dredge to -8 feet plan that the two 55 foot boats would experience 42 tidal delays a year lasting 1-1/2 hours each, and that each would experience, on average, yearly grounding damages of $700.

Similarly, for the analysis of the dredge to -6 feet plan, it was estimated that the 47 foot boat would experience 42 tidal delays a year lasting 1-1/2 hours each, and it would experience yearly grounding damages of $700.

The data in Table 2-18 and the data in the "Operational Cost Savings" section of Tables 2-19 through 2-21, were obtained directly from Gloucester fishermen. Inspection of the data by boat indicted a break at 40 feet. The captain and crew in most New England ports are compensated on a "lay" system. Under this system joint expenses (food, ice fuel, etc.) are deducted from gross stock and the remainder is divided evenly between the crew and the boat, with the Captain receiving an extra half share. The larger boats tend to have a larger crew with higher wages for captain and crew. The hourly wage is taken as a measure of value of the labor saving. The larger boats also consume more fuel pr hour when underway.

The data supplied by the fishermen seemed reasonable when compared with annual income statement generated by the National Marine Fisheries Vessel Financial Simulator.

TABLE 2-18

Input Valuation by Boat Size, Hourly

	<40'	40'
Captain	$10	$12
Crewman	7	8
2nd Crewman	0	8
Fuel	4	9
TOTAL	$21	$37

Benefits to the project are operational cost savings to the nine boats which, without the project, would be forced to relocate to ports in either Beverly or Ipswich, Massachusetts. With the project, the boats would not be displaced and as such would not incur additional operating expenses. With the dredge to -10 feet plan, full benefits for all nine boats would be realized. The benefit computation and total benefits realized with the dredge to -10 feet plan are presented in Table 2-19.

TABLE 2-19
Dredge to -10 Feet Benefit Computation

Operational Cost Savings by Preventing Displacement

	# Boats		# Trips		Additional Hours Per Trip		Hourly Cost		Total Benefits for Dredge to -10 feet
boats < 40'	6	x	200	x	3	x	$21	=	$75,600
boats > 40'	3	x	150	x	3	x	$37	=	$49,950
									$125,550
							SAY		$126,000

Benefits for the dredge to -8 feet plan equal the benefits of the -10 feet plan less the cost of tidal delays and grounding damages for the two 55 foot boats. The benefit computation and total benefits realized with the dredge to -8 feet plan are presented in Table 2-20.

TABLE 2-20
Dredge to -8 feet Benefit Computation

Operational Cost Savings by Preventing Displacement:

	# Boats		# Trips		Additional hours per trip		Hourly Cost		Total
boats <40'	6	x	200	x	3	x	$21	=	$75,600
boats >40'	3	x	150	x	3	x	$37	=	49,950
									$125,950

Cost of Tidal Delays and Grounding Damages of two 55 foot Boats:

# Boats		# Tidal Delays		Hours per delay		Hourly Cost		Total
2	x	42	x	1-1/2	x	37	=	$4,662

# Boats		Average Annual Grounding Damages		
2	x	$700	=	1,062
				$6,062

Total Benefits for Dredge to -8 feet Plan:

Operational Cost Savings Preventing Displacement		Cost of Tidal Delays and Grounding Damages		Total Benefits for Dredge to -8 feet
$125,550	-	$6,062	=	$119,488
			SAY	$119,000

Benefits for the dredge to -6 feet plan, since the two 55 foot boats will still be displaced to other harbors, equal operational cost savings for the remaining seven boats less the cost of tidal delays and grounding damages for the 47 foot boat. The benefit computation and total benefits realized with the dredge to -6 feet MLW plan are presented in Table 2-21.

TABLE 2-21
Dredge to -6 feet Benefit Computation

Operational Cost Savings by Preventing Displacement:

	# Boats		# Trips		Additional hours per trip		Hourly Cost		Total
boats <40'	6	x	200	x	3	x	$21	=	$75,600
boats >40'	1	x	150	x	3	x	$37	=	16,650
									$92,250

Cost of Tidal Delays and Grounding Damages of 47 foot Boats:

# Boats		# Tidal Delays		Hours per delay		Hourly Cost		Total
1	x	42	x	1-1/2	x	37	=	$2,331

# Boats		Average Annual Grounding Damages		
1	x	$700	=	700
				$3,031

Total Benefits for Dredge to -6 feet Plan:

Operational Cost Savings Preventing Displacement		Cost of Tidal Delays and Grounding Damages		Total Benefits for Dredge to -8 feet
$92,250	-	$3,031	=	$89,219
			SAY	$89,000

Economic Justification

The benefits and costs of each plan are compared to determine economic justification. A benefit/cost ratio of 1.0 to 1 or greater is required for Federal participation in water resources improvement projects. Table 2-22 presents the benefit/cost comparison of the three alternative navigation improvement plans.

TABLE 2-22

Benefit/Cost Comparison

	Annual Costs	Annual Benefits	Net Annual Benefits	Benefit/Cost Ratio
Dredge to -6 feet	$45,000	$89,000	$44,000	2.0
Dredge to -8 feet	$62,000	$119,000	$57,000	1.9
Dredge to -10 feet	$83,000	$126,000	$43,000	1.5

WATER RESOURCES IMPROVEMENT STUDY
SMITH COVE, GLOUCESTER HARBOR
GLOUCESTER, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

APPENDIX 3

PERTINENT CORRESPONDENCE RECEIVED

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

APPENDIX 3

PERTINENT CORRESPONDENCE RECEIVED

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SUMMARY OF RESPONSES TO DRAFT REVIEW COMMENTS

SECTION B

COPIES OF CORRESPONDENCE RECEIVED PRIOR TO REVIEW OF DRAFT REPORT

Massachusetts Dept. of Env. Management	- May 10, 1989
Massachusetts Dept. of Env. Management	- May 10, 1989
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City of Gloucester, MA.	- March 11, 1981

APPENDIX 3

SECTION A

COPIES OF CORRESPONDENCE RECEIVED
FROM REVIEW OF DRAFT DETAILED PROJECT RREPORT

CITY OF GLOUCESTER

GLOUCESTER • MASSACHUSETTS • 01930

February 23, 1990

Don Birmingham
Army Corps of Engineers
11 Buck Hill Road
Tyngsboro, Massachusetts

Re: Smith Cove Dredge Project

Dear Mr. Birminham,

This letter will confirm the Gloucester Waterways Commission's support of the Smith Cove Dredge Project.

Commercial boats in Gloucester have been displaced by changes in the Harbor . Over forty commercial vessels are on a waiting list for dockage, with this number sure to increase with further disruptions. Commercial vessels are rafting three and four deep.

Smith Cove offers the last protected area which can support commercial moorings. It is ideal for the mooring of smaller commercial vessels. We are aware of the concerns of some neighbors, and feel the City is capable of responding to them, particularly as many stem from misunderstanding of the project.

The Commission believes this dredge project is important to the future of the commercial fishing industry in Gloucester, especially as the complexion of our fleet changes to more smaller and mid-sized vessels .

Sincerely,

Thomas Hill

Thomas Hill, Chairman
Gloucester Waterways Commission

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Region
Management Division
Habitat Conservation Branch
One Blackburn Drive
Gloucester, MA 01930-2298

December 22, 1989

Joseph Ignazio
Chief, Planning Division
New England Division
Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Dear Mr. Ignazio:

More up-to-date information is needed to adequately evaluate the proposed navigational improvements for Smith Cove in Gloucester Harbor, Gloucester, Massachusetts. Project plans call for dredging a 1000 foot long access channel, 80 feet wide by 8 feet deep, along the west side of Smith Cove, to a 2.5 acre, 8 foot deep anchorage to be dredged at the south end of the cove. Approximately 33,000 cubic yards of material would be removed by clamshell dredge and disposed of at the Massachusetts Bay disposal site.

Smith Cove is an embayment of approximately 22 acres located in East Gloucester. The upland is extensively developed with both residential and commercial establishments. Intertidal areas consist mostly of coarse rubble with approximately 4 to 5 acres of mudflats at the south end of the cove. This area supports a macrobenthic community of rockreed, sea lettuce, blue mussels, soft-shelled clams, sand worms, periwinkles, barnacles and other invertebrates. Resident and migratory finfish species within the project area include: winter flounder, Atlantic silversides, stickleback, mummichog, Atlantic and blueback herring, mackerel, bluefish, and smelt.

ECONOMIC ANALYSIS

Justification of this project is based on the assumption that the commercial fishing industries would expand or maintain its status quo. The abundance of New England groundfish and other finfish species has been declining. Since 1978, the abundance index for New England groundfish (12 species) has decreased steadily. The 1987 index value was among the lowest in the time series which began in 1962. The abundance index of the other finfish (10 demersal and 5 pelagic species) has shown a similar trend in recent years (1978-1987). The landings, catch per unit of effort and earnings of the trawl fleet have experienced a drastic decline. Total landings of species caught by trawlers peaked in 1983 at 186,000 mt. and declined steadily to 113,000 mt. in 1987, a decrease of 40%. Since 1980, catch per day fished has declined steadily, and in 1987 it was 50% of the 1980 value. Net income to trawl boat owners and net crew share to trawl fishermen have deteriorated. For example, net vessel income for vessel sizes 51-150 tons dropped to about $7,500 (1975 constant dollars) in 1986 from its peak of $46,000, a 84% decline. Net vessel income was estimated to experience a loss of approximately $1,000 in 1985. The New England fleet declined by 18% to 1334 vessels in 1987 from 1624 vessels in 1983.

Data used by the Corps to analyze the industry (1974-83) is relatively out of date. Since 1983, a drastic change has occurred in the New England fishing fleet, specifically Gloucester. The B/C ratio was calculated by theorizing that nine vessels were being forced out of Gloucester Harbor because of on-shore development and would have to relocate to another community in Massachusetts. Therefore, these displaced nine vessels are the major premise for the improvements to Smith cove because these vessels would relocate there. However, the Gloucester fleet may have declined by more than nine vessels since this B/C analysis was conducted. If the fisheries is on a decline, then it also follows that some of the fishing vessels would also decline. As such, the port capacity problem may be resolved and a new anchorage may not be necessary. Therefore, we suggest that the B/C ratio be recalculated using more recent fishery statistics.

It is unclear how the displaced vessels (9 vessels) were selected. If these vessels are the same vessels which immediately lose their facility because of the on-shore-development projects, then perhaps these vessels should not be used in the analysis. In theory, these vessels, upon loss of their facilities, will compete with the rest of the Gloucester fleet for space and economics will dictate how many and which vessels will be forced out of port. This implies that the selection of the affected vessels groups can make a difference in the B/C ratio.

Benefits in cost-savings derived from eliminating extra transport time from fishermen's residences to homeports to fishing grounds may be over-estimated; in particular, the costs associated with the captain and crews' labor costs. It is not unreasonable to expect that 100% of the fishermen and captains' extra time will be used to generate income.

Positive net benefits do not necessarily lead to expansion of the fleet, as argued in the analysis (pg. 5). According to a recent article in the Gloucester Daily Times, the total profits of the Gloucester fleet have been declining over time. The number of commercial fishing boats have declined in the last decade from 325 to 217.

Benefits derived from reducing tidal delays, in our judgment, may be overestimated:

1) Fishermen can avoid the delays by carefully planning their trips;

(2) Most fishermen probably do not have a second job to generate income if time is saved in tidal delays;

(3) Extra trips may not be made with the time saved since the New England otter trawl fisheries are in a depressed state and regulations imposed by the fisheries management councils may prohibit fishing in certain areas and/or at certain times.

Alternative benefits such as commercial activities in recreational fishing as well as recreational activities (fishing and whale watching) should be examined. Whale watching is becoming a significant activity in Gloucester.

WETLAND ANALYSIS

This project will have unacceptable impacts on the intertidal habitat. The embayment supports a host of organisms, particularly the intertidal areas (see species list above). According to the FWS calculations and our on-site investigation, it appears that adverse impacts to intertidal habitats are much greater than that presented in the document. Approximately 1.5 acres of intertidal habitat would be affected by dredging; not 0.04 acres as identified on page EA-12 of the document. To avoid impacting the intertidal area the anchorage should be sited no closer than -2 or -3 feet at MLW or 50 feet horizontally from intertidal habitat. This distance should buffer the intertidal zone from impacts associated with commercial uses of the anchorage.

Review of the chemical analysis and bioassay of the proposed sediments indicates that the dredged material, silt/clay is significantly contaminated with oil and grease, copper, zinc, and lead. According to the document, copper and PCB levels appear to be above Environmental Protection Agency water quality standards. The dredged material has statistically significant levels of PCBs in grass shrimp and according to EPA, unrestricted ocean disposal of these sediments is unacceptable. Furthermore, the bioassay-bioaccumulation test results also showed uptake levels of petroleum hydrocarbons in grass shrimp and sand worms. Despite these conditions the Corps found the material to be ecologically suitable for open water disposal based on the same bioassay- bioaccumulation studies. These studies were conducted in accordance with testing protocol of the 1981 EPA/COE ocean dumping implementation manual. This testing protocol has been the subject of major controversy between the environmental agencies and the Corps since its implementation. Because of the controversy, new testing technics were developed by a joint effort of the EPA, COE, USFWS and NMFS. Therefore a revised Open Water Disposal Dredge Material Testing Protocol has recently been developed and, as of August 15, has been implemented by EPA. The new testing protocol incorporates a tiered approach to bioassay-bioaccumulation analysis, new chemical parameters to be tested for, updated detection limits, new test organisms, and quality assurance/quality control procedures. Therefore, we believe the Smith cove sediments should be analyzed according to the more recent testing protocol.

CONCLUSIONS

In summary, we believe that the B/C ratio is based on inappropriate information and recommend that it be recalculated using up-to-date data. Furthermore, dredging to create the anchorage would permanently eliminate 1.5 acres of productive intertidal habitat. This impact is unacceptable since it can be avoided by locating the anchorage no closer than -2 or -3 feet MLW or 50 feet horizontally from the intertidal habitat. Finally, we believe the dredge material needs to be retested using the latest bioassay/bioaccumulation protocol developed by the EPA, CORPS, FWS and NMFS. Under the present evaluation the dredge material is unacceptable for ocean disposal and we recommend that a contained upland disposal site be investigated.

If you have any questions please contact Chris Mantzaris at (508) 281-9346.

Sincerely,

Thomas E. Bigford
Branch Chief

... MASSACHUSETTS 02203-2211

November 27, 1989

Colonel Daniel M. Wilson
Division Engineer
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

Dear Colonel Wilson:

This letter is in response to your letter dated August 25, 1989 requesting EPA to review the Draft Section 107 navigation Detailed Project Report, including an Environmental Assessment, Section 404(b)(1) Evaluation, and a Finding of No Significant Impact for navigation improvements in Smith Cove, Gloucester, MA. We object to this project for three reasons which are discussed in detail below.

First, the need for the project has not been clearly established. The project improvements consist of the dredging of an access channel along the west side of Smith Cove and the dredging of an anchorage area at the south end of the cove. The proposed improvements appear to exclusively benefit commercial fishing. Currently, we believe that the existing channels in Gloucester are sufficient.

Secondly, the project will have unacceptable impacts to intertidal habitat. The project site (Smith Cove) is located in Gloucester Harbor between East Gloucester and Rocky Neck, an embayment which is approximately 22 acres in size. At the south end of the cove there are approximately 4 to 5 acres of intertidal mud flats supporting a macrobenthic community which includes: rockweed, sea lettuce, blue mussels, soft-shelled clams, sand worms, periwinkles, barnacles, and other invertebrates. The embayment supports a host of finfish species such as Atlantic silversides, winter flounder, stickleback, mummichog, mackerel, smelt, and herring. As noted in the project report, a snowy egret and palmated plovers were observed feeding on the mud flat. Other waterfowl such as black duck, red-breasted mergansers, herring gulls, terns and various shore birds, use the intertidal flats for resting and feeding. Therefore, the Corps of Engineers should investigate a less damaging practicable anchorage alternative to alleviate dredging intertidal mud flat pursuant to Section 230.10(a) of EPA's 404(b)(1) guidelines. We recommend that the proposed anchorage area be sited to avoid direct or indirect impacts to intertidal habitat at the southern end of Smith Cove.

Thirdly, there appears to be the potential for environmental impacts as a result of open water ocean disposal. Review of the chemical analysis and bioassay of the proposed dredged sediments

NOV 29 1989

indicates that the dredged material has increased levels of PCB. The elutriate test results elucidated that a potential for PCB mobility and availability to <u>Paleomonetes sp</u>., a detritus feeding crustacean, exists. The bioaccumulation test results showed statistically significant bioaccumulation of PCB, 0.09 ppm, over a ten day period. Based on these test results, EPA would not allow unrestricted ocean disposal of these sediments.

As stated at 40 CFR §227.16(a)(2), the basis for determining the need for ocean disposal is dependent in part on whether alternatives exist. EPA does not believe that a reasonable range of alternatives to ocean disposal have been explored. Permits for ocean disposal should not be issued until such an analysis is completed.

To date, the use of capping for contaminated sediments as a viable management option at the Massachusetts Bay Disposal Site, an EPA approved interim ocean disposal site formerly called the "Foul Area", remains uncertain. Before disposal of this material is permitted at the site, the Corps must demonstrate that with proper site management (taut line buoys, monitoring of point dumping, etc.) that capping is a feasible and implementable alternative at the site. The Corps should investigate an environmentally preferable alternative to ocean dumping such as the use of an environmentally acceptable upland disposal site.

Please keep us informed of any progress on this project and do not hesitate to contact either Mr. Melvin Holmes at (617) 565-4433 or Ms. Kymberlee Keckler at (617) 565-4432 should you have any questions.

Sincerely,

David A. Fierra, Director
Water Management Division

cc: NMFS, Gloucester, MA
USFWS, Concord, NH
Ronald G. Manfredonia, Water Quality Branch
Douglas A. Thompson, Wetland Protection Section
Gwen S. Ruta, Marine and Estuary Protection Section

CITY OF GLOUCESTER

GLOUCESTER · MASSACHUSETTS · 01930

PLANNING BOARD

November 7, 1989

Mr. Donald Birmingham
The Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

RE: Smith's Cove Dredging
East Gloucester, MA

Dear Mr. Birmingham:

On November 6, 1989, the Gloucester Planning Board voted unanimously to once again strongly support the dredging of Smith's Cove.

This dredging project is consistent with the following policy statement in our draft Community Development Plan:

> " Ease navigation in the harbor by encouraging dredging, removing hazards to navigation, and enforcing the Harbor Commission Line as the absolute limit of private activity."

We commend your efforts and urge the Corps of Engineers to proceed as rapidly as possible.

Sincerely,

Dale A. Pope
Chairman

cc: Harbormaster James Marr

Mr. Donald Birmingham
The Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Dear Mr. Birmingham:

I live near Smith Cove and have moored my sailboats there for many years. But, I have been among the fortunate few, since the useable space and public access are so unnecessarily limited.

The long anticipated dredging project, that would benefit so many, is overdue.

The use of this rare natural resource for the recreational enjoyment of the public should be given high priority.

I strongly support the dredging project, and the expanded public access to Smith Cove.

Sincerely,

Thomas Bernie
4 Gerring Road
Gloucester, MA 01930

cc Mayor William Squillace
City Hall, Gloucester, MA

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

COASTAL ZONE
MANAGEMENT

25 ~~September~~, 1989 rec'd
October

Col. Daniel M. Wilson
Division Engineer
New England Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

RE: Proposed Smith Cove (Gloucester Harbor) Navigation Improvements

Dear Col. Wilson:

The Massachusetts Coastal Zone Management Office has completed its review of the above referenced Draft Detailed Project Report and Environmental Assessment (DPR/EA), and offers the following comments.

1. Our preliminary comment letter of 10 July, 1986 (attached) raised a number of questions and concerns which appear not to have been directly addressed in the Draft DPR/EA. In particular, we question the decision to allow the material to go to the Foul Area (Massachusetts Bay) Disposal Site. Without going into greater detail, we will simply say that we strongly agree with the comments of the USFWS, in their letter of 28 August, 1989, regarding the suitability of the material for unconfined ocean disposal. Additional testing, using the most recent protocols is indeed very appropriate given the results of the testing done thus far.

2. This project appears to involve the loss of greater than 1.5 acres of intertidal mudflat. Again, we echo the comments of the USFWS in objecting to what appears to be an avoidable loss of intertidal habitat. We agree with the suggestions of the USFWS regarding the re-design of the anchorage to avoid unnecessary loss of this important habitat.

3. As this project involves the discharge of dredged material into coastal waters, the issuance of state water quality certification by the DEP, Division of Water Pollution Control will be required. Such Certification should be submitted to MCZM by the Corps with its Determination of Federal Consistency for the project.

4. No analysis of cumulative or secondary impacts appears to have been completed for the project. Of particular concern in this regard are the effects on the project resulting from secondary shoreside and waterfront development induced by the dredging. An analysis undertaken to address this concern is not, as the Corps has previously suggested, local

waterfront planning, which we agree is a responsibility of the municipality, but to address how this induced development might affect the proposed project. Also, given the proposed destruction of intertidal mudflat, no analysis was provided of other projects involving such losses which have occurred in the past, those associated with projects currently under construction or being planned for the Gloucester Harbor area, or any project for which such a loss might be reasonably expected to occur in the future. While we recognize that such analyses are difficult, this should not be used as an excuse to avoid a "good faith" attempt to comply with the requirements embodied in the 404(b)(1) guidelines regarding cumulative impact anaylses.

Thank you for the opportunity to review the Draft DPR/EA. Should you have any questions regarding our comments, please contact Brad Barr of my staff at 727-9530.

Sincerely,

Jeffrey R. Benoit

Jeffrey R. Benoit
Director

JRB/BWB
Attachment
cc: John Simpson, DEP/DWWR/WRP
Judy Perry, DEP/DWPC
Eugene Cavenaugh, DEM/Waterways
Mike Tehan, USFWS/Concord
Tom Bigford, NMFS
Doug Thompson, EPA/Region 1
Harbormaster, City of Gloucester
Fara Courtney, MCZM/North Shore

October 25, 1989

Mr. Donald Birmingham
The Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

RE: Smith Cove Dredging
East Gloucester, MA 01930

Dear Mr. Birmingham:

I am a property owner and user of Smith Cove located at 257 East Main Street.

For almost twenty years I have followed the progress of increasing usable mooring area in this terrific resource.

It's refreshing to see a waterfront project that encourages dredging and boating use rather than the destruction we've witnessed over the years through fill.

Please record us in favor of this worthwhile project. I hope the city expands the project to include a ramp and dinghy float from the Rocky Neck parking lot to provide additional public access.

Sincerely,

John Bell

John Bell
257 East Main Street
East Gloucester, MA 01930

cc Mayor William Squillace
City Hall, Gloucester, MA

LAW OFFICES
OF
J. MICHAEL FAHERTY

63 MAIN STREET
GLOUCESTER, MA 01930
TELEPHONE (508) 283-9233
(508) 281-0999
FAX (508) 283-0314

October 23, 1989

Mr. Donald P. Birmingham
Amry Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

RE: Smith's Cove, Gloucester navigation improvements

Dear Mr. Birmingham:

Be advised that I represent my parents, John and Mildred Faherty, who own the land colored orange on the attached copy of a Smith's Cove plan, and, as of January 26, 1990, my wife and I will be the owners of land colored blue on the same attached plan.

Please record us in favor of the Army's planned dredging project in Smith's Cove. Also note that we are currently exploring the possibility of piggy-backing on your project to get our waterfront dredged at the same time.

Smith's Cove is a tremendous resource to the City of Gloucester in general and to Rocky Neck specifically. It offers protection to boaters in all weather, and as far as we are concerned, the more of it that is dredged the better.

Sincerely,

Michael Faherty

J. Michael Faherty

JMF/am
encl.

CITY OF GLOUCESTER

GLOUCESTER · MASSACHUSETTS · 01930

October 20, 1989

Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Attention: Colonel Daniel M. Wilson

Dear Colonel Wilson:

The City of Gloucester has reviewed the Draft Detailed Project Report and Environmental Assessment and concurs with the findings of your department.

The Harbormaster's Office, Waterways Commission and the Community Planning and Development Office are coordinating efforts on the project in behalf of the city. Representatives of the Rocky Neck Area Association have also been invited to meet with the Waterways Commission in order to discuss the project and to clear up any misconceptions relative to the dredging and future planning.

We are able and willing to finance our cost share of the project and request that the Corps of Engineers continue on a course leading to the finalization of the Smith Cove Construction Project.

Sincerely yours,

William B. Squillace
Mayor

mt

SEP 26 1989

ROCKY NECK AREA ASSOCIATION
GLOUCESTER, MA 01930

September 20, 1989

Daniel M. Wilson, Division Engineer
Colonel, Corps of Engineers
Department of the Army
424 Trapelo Road
Waltham, MA 02254-9149

Dear Colonel Wilson:

The Rocky Neck Area Association is a neighborhood organization of up to 100 members. Our membership area includes the island of Rocky Neck in Gloucester Harbor and the waters around the island including Smith Cove, Wonson Cove, as well as uplands in the surrounding areas along East Main Street and Eastern Point Road, as well as the causeway to Rocky Neck, which runs from East Main Street over to the island between Smith Cove and Wonson Cove in the waters of Gloucester Harbor.

A number of members, including some who were born and brought up here and who have spent a good part of their lives on the waters in the area, have reviewed the report entitled DETAILED PROJECT AND ENVIRONMENTAL ASSESSMENT, INCLUDING SECTION 404 (b) (1) EVALUATION, SMITH COVE, GLOUCESTER HARBOR, GLOUCESTER, MASSACHUSETTS, released for public review August 25, 1989. Our membership has raised the following comments and concerns.

PROJECT JUSTIFICATION: Since the initiation of the study in the early 1980's, much has changed in Gloucester Harbor and within the fleet of fishing vessels which has operated out of Gloucester during the decade of the 1980's. We find much of the narrative in the report out of date as it relates to current fishing and dockage conditions.

The project justification is to provide additional mooring and dockage for nine commercial fishermen who were displaced from the State Fish Pier during major renovations there during the 1980's. In the spring of 1989, the State Fish Pier Advisory Board voted to allocate a sum of money it controls to allow building a small boat dockage at the southeastern end of the State Fish pier, with construction due to start as early as spring, 1990. This dockage will adequately provide for those who were earlier displaced from the Pier and is located in the same general area, at the mouth of Smith Cove from the main Channel, as the area of proposed dredging. Therefore, we question the need for spending $600,000+
of the taxpayers' money to dredge a 2 1/2 acre mooring basin for commercial fishermen who will already have been provided for at the State Fish Pier.

MOORING FOR COMMERCIAL FISHERMEN OR A "MEGA MARINA" FOR THE RECREATIONAL INTERESTS ABUTTING THE PROPOSED AREA OF DREDGING?

In the last several years, neighbors have witnessed a proliferation of marina-like activity on the property of abuttors to Smith Cove, much of which is improperly permitted, and some of it with no permits at all. Long lengths of floats and walkways and also pilings have appeared out over private tidelands stretching toward the area of the proposed dredging, some of it allegedly interfering with the harbor commissioner's line. The result may be seen in sequential aerial photos, a decrease in the navigable waters at high tide within the waters of Smith Cove, coupled with serious congestion, the activity now almost exclusively dedicated to yachts and other pleasure craft.

Our members are concerned that even though the proposed dredged mooring basin is supposed to be dedicated solely to commercial fishermen, that other interests will eventually find a way to control the dredged mooring basin and the nine moorings within it. We fear that it will turn into a <u>luxury boat marina operation</u>, which will be paid for via our federal tax dollars and that the dredging will end up being a federal grant to a few abutters, whose property values will soar and who will end up controlling the moorings, the basin and virtually all of the access to it. We fear that this process will lead to gentrification, pumping up real estate values in the area, making it virtually impossible for local people to continue to live and work here, or to enjoy the use of Smith Cove.

ECONOMIC JUSTIFICATION AND STUDY: While the report attempts to address the economics of the fishing interests who will allegedly be served by the dredging, no efforts have been made to study the impacts on the neighborhood surrounding Smith Cove, on the real estate values and the potential dislocation of other area jobs and businesses, the loss of affordable housing, etc., which is produced by gentrification.

The Rocky Neck art colony is the oldest continuously working art colony in America. Artists have traditionally depended on affordable rents of gallery and living space in the area, much of which would disappear as property values sky rocket around the area of the proposed dredging. This would be a tragedy of national proportions, especially if it were a spin-off from a federally paid for Corps dredging program.

DEFINING "COMMERCIAL" AND "FISHING" OR "FISHERMEN": It is imperative for the word "commercial" to be clearly defined in the report. It should be defined to mean "COMMERCIAL FISHING or COMMERCIAL FISHERMEN" so that there can be <u>no interpretation of it</u> in the future to mean "commercial, i.e._recreational boating or marina commercial". Every place the word "commercial" appears in the report, it should be amended to state "commercial fishing" or "commercial fisherman", etc. so that there can be no misunderstanding that the area of proposed dredging is specifically for the commercial fishermen. In the report as presented, that is not the case and leaves room for too broad an interpretation of what the word "commercial" pertains to.

LOCAL COMMITMENT AND LOCAL MATCHING SHARE: Page 21 of the report outlines Gloucester's commitment in meeting the Corps' demands for certain project conditions which are unacceptable to many area neighbors and residents. We doubt the City's ability to provide and pay for such facilities, under current fiscal constraints, and we have very little faith in the ability of the City to maintain such amenities in an acceptable fashion. In fact, the City's management of many of its public areas , including town landings, has been disgraceful, sloppy, underfunded and has resulted in some cases of the loss of the public properties to abuttors and other encroachers, and to groups who have taken control to such an extent that the general public is unwelcome, even in areas where federal tax dollars have paid for the improvements, as is the case of the Town Landing at St. Peter's Park in downtown Gloucester.

Some residents of Rocky Neck have no intention of allowing similar situations to evolve in the precious parking lot which abuts the area of proposed dredging or to put up with loud and raucous behavior in a proposed dredged basin which would interfere with the peace and tranquility of the neighborhood as a whole. The city has presented no plan, which relates to the facilities outlined on page 21 of the report. Furthermore, we believe that a title search will negate some of the representations made in letters included in the report, especially one dated March 8, 1984 and signed by the then Harbormaster, Earland Worthley, which in section 2 says the City is willing to give a quitclaim covenant to the federal government for all City owned tidelands below the high water mark at the end of Smith Cove. We question the authority of such a representation and the ability of the City to make such a claim without an Act of the Legislature.

ENVIRONMENTAL CONCERNS: Smith Cove, even before the building of the causeway across it, was poorly flushed, due to differentials in the level elevations as they occurred naturally on both sides. Flushing occurs seasonally, other than daily or monthly, a natural condition which invites further pollution as the intensity of boating in the cove increases. There are not facilities for the pumping out of sewage from vessels at the present time in the Smith Cove area, although the municipal sewer runs along East Main Street and Rocky Neck Avenue, often within a few feet of the cove itself in several locations. The Corps should insist that all public facilities serving the boating public in Smith Cove, including restaurants and boat yards, have pump-out facilities which discharge directly into the City sewer lines, thereby lowering the potential further degradation of the waters, a Corps responsibility.

BORING SAMPLES: We note that many of the boring samples were done far enough off-shore that they were <u>away from</u> the areas where vessel repair in and around the Cove was most likely to reveal highly polluted samples from boat repair, marine paints, etc.

WILDLIFE: The report makes no reference to the recent increase in populations of swans and loons which our members have repeatedly reported sightings of, frequently in the very area of the proposed 2 1/2 acre dredged basin. We note that the Common Loon is considered to be a threatened species, and has been a frequent visitor to Smith and Wonson Coves in the last three years, where apparently breeding adults with chicks have been sighted. The loon families have arrived in early June and summered over here since 1986. Sometimes these loons find their way into Smith Cove where, especially during storms, they appear to find more shelter.

HISTORICAL: Smith Cove is one of the most historic seaport areas in the nation. Champlain discovered the area in 1603 and came ashore at the head of the cove, with "savages" all around. An active trade between Surinam in South America and GLoucester took place from 1810 to 1860, with warehousing on the edge of the cove. The Marine Railways is one of the first in the Commonwealth and the steam engine came from a vessel engaged in the first naval battle of the Civil War between the Monitor and the Merrimac. The Cove was home port to hundreds of schooners during Gloucester's dory fishing fleet days in the 1800's and early 1900's. No mention is made of these significant resources in the report.

For these and many other reasons,the Rocky Neck Area Association does not, at this time, support the proposed dredging project in Smith Cove, Gloucester, Harbor.

SIncerely,

Carolyn M. O'Connor, Chairman
Rocky Neck Area Association

cc. Mayor William Squillace
Everett Brown, City Council President
Jeff Benoit, Director CZM
Fara Courtney, CZM
Christy Foote-Smith DEP
Daniel Greenbaum, DEP

U.S. Department of Transportation
United States Coast Guard

Commander
First Coast Guard District

408 Atlantic Avenue
Boston, MA 02210-2209
Phone:
Staff Symbol:

(617) 2[illegible]
(oan)

16500

Colonel Daniel M. Wilson
Division Engineer, New England Division
Department of the Army, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Dear Colonel Wilson:

I have recieved and reviewed your proposal for improving the Smith Cove section of Gloucester Harbor, Gloucester, Massachusetts. At this time I see no need for establishing federal (Coast Guard) aids to navigation.

Should the local harbormasters of the improved Smith Cove see a need for aids to navigation, I would encourage him to submit an application for private aids to this office.

If you have any questions, please contact Lieutenant (junior grade) Joe McGuiness or myself at the above number.

Sincerely,

N. C. EDWARDS, JR.
Captain, U. S. Coast Guard
Chief, Aids to Navigation Branch
By direction of the Command

Joan Kerry
19 Rocky Neck Av.
Gloucester, Ma.01930

September 21, 1989

Mr. Joseph Ignazio, Chief
Planning Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Mr. Ignazio:

I am a property owner on Smith's Cove in Gloucester, Massachusetts. I have read the report on the plans to dredge Smith's Cove and am deeply concerned about it's impact on me and on the environment.

The chief purpose of the project is to provide docking space for shallow draft commercial fishing vessels. Since the fish pier board voted to release the money left from the old fish pier before Mass Bank took it over, the money is now available to provide floats in a protected spot off the pier for these commercial boats. There would be space to unload them that wouldn't intrude on a residential neighborhood already overcrowded and with a parking problem. My house is situated on pilings in Smith's Cove. Because it is illegal to construct any new commercial marinas in the cove, I wonder if the owners of the many increasingly long floats can afford to remove them in the winter, so they won't break up with the ice and threaten the foundations of my house, particularly in a storm? Although there have been promises, they have not been removed, during the winters, up to now. The site off the old fish pier, unlike Smith's Cove which is often frozen over in the winter, would provide winter access, as the channel is open all winter. Another concern I have is that, if no money for this project is to come from the city, where will the $62,000 necessary to maintain upkeep of the dredging come from?

Smith's Cove is one of the most picturesque spots on the North Shore, attracting many tourists and generating revenue for the city. Only last week I saw a blue heron standing where the proposed new pier would go. With the inevitable proliferation of yet more of the many floats for pleasure craft already evident in anticipation of the dredging, the egrets, mergansers kingfishers and other species I have observed feeding in the waters outside my house would surely disappear, along with the minnows on which they feed.

With great concern,

Joan Kerry

Joan Kerry

275 E Main St
Gloucester MA. 01930

September 21,1989

Joseph Ignazio
Chief Planning Division
U.S Army Corp of Engineers
424 Trapelo Rd
Waltham, MA 02254-1949

Dear Mr. Ignazio,

I am writing about my concern regarding the proposed dredging program in Smith's Cove in East Gloucester.

I understand the need to provide more docking space for the smaller commercial boats of Gloucester. It seems that Mayor Squillace has come up with a proposal to meet this need on the harbor front in a much more accessible area to the sea for the boats.

My question is] What is the reason to continue this project?

My concern is] This is a dead end cove. We see a shore line strewn with debris, plastic bottles, oil surfaces, and many of the normal collections found along a shore line where there is no outlet to the sea.
I propose that, if, this project is considered, that a prime consideration be that of creating a tunnel under the causeway for the ebb and flow of the tides to keep our cove free from stench and collection of the rubbish carelessly dumped into our ocean by boaters, commercial and pleasure.

When we purchased our property, residential and commercial usage, in 1979, to conduct a business we had to be within a 400 foot public parking area to serve our customers as the parking on East Main Street is minimul. The parking lot on the Causeway is 400 feet from the building, therefore, we need to protect any furthur use of that area.

My concern is] Allowing commercial fishermen to use a Public Landing space to reach their boats will cause a parking problem for any restaurant, gallery, resident of Rocky Neck and East Main Street. Each commercial fisherman owns a truck, and each worker a truck or car and where are they going to park???

Until a visible plan is presented to all abutters of land and sea in Smith Cove , and viable reasons expressed for the need to invade the most acknowledged historic art colony in the world, hamper their continued business by taking away parking places for their clients, eliminating areas for the residents to use the parking lot, creating congestion in an already limited piece of land, letting oil and gasoline cover our waters, introduce noises of engines starting up at four in the morning, hearing voices of language only fishermen know, debris lining the shore, seeing lobster pots or gear lined up ready to use or store, and so forth. I trust the Corp of Engineers, and our city officials, and our residents will be able to meet at a table to discuss all of the above.

There are other issues regarding this project that concern me, however, this is .. a dead end cove... that I believe should have priority before a dredging program is considered.

Yours truly,

Ruth A. Brown

Ruth A. Brown

OD

3 Clarendon St.,
Gloucester, MA 01930
Sept. 21, 1989

Dear Sir,

As a person who was opposed to dredging Smith's Cove, for many reasons, including increased congestion in the cove, and an increase in our already severe parking problems, I am happy to state that the dredging is no longer necessary. Facilities that are more than adequate for small fishing boats have been found in a more suitable area.

Yours Truly,

Judith W. Chamberlain

(Mrs. Alden Chamberlain II)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
400 RALPH PILL MARKETPLACE
22 BRIDGE STREET
CONCORD, NEW HAMPSHIRE 03301-4901

August 28, 1989

Joseph Ignazio
Chief, Planning Division
New England Division
Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Mr. Ignazio:

This is in response to your letter of July 19, 1989, requesting our views on the draft Detailed Project Report and Environmental Assessment for the small navigation project at Smith Cove, Gloucester Harbor, Massachusetts. We hereby submit our final Fish and Wildlife Coordination Act Report on the project in accordance with Section 2(b) of the Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq.

The proposed project involves dredging a 1000-foot long access channel, 80 feet wide by 8 feet deep, along the west side of Smith Cove, to a 2.5 acre, 8-foot deep anchorage to be dredged at the south end of the cove. Approximately 33,000 cubic yards of silt/clay material would be removed with a clamshell dredge and disposed of at the Foul Area Disposal Site (FADS). This material is significantly contaminated with oil and grease, copper, zinc, and lead. Testing indicates a potential for copper and PCB elution above Environmental Protection Agency (EPA) water quality criteria.

This office provided comments on the proposed navigation project early in the planning process. Our letter of July 2, 1986, noted that no known federally listed threatened or endangered species were known to occur in the project vicinity. Our March 22, 1985, letter to the Planning Division identified fish and wildlife resources and habitat conditions in the project area. We also identified potential resource impacts of the project and recommended measures to avoid those impacts. The following comments reiterate our previously stated concerns regarding the unsuitability of the material for open water disposal, biological testing protocols for contaminated dredged material, and the loss of productive intertidal habitat from dredging.

Smith Cove is an embayment of approximately 22 acres located in Gloucester Harbor between East Gloucester and Rocky Neck. The shoreline is extensively developed with houses, piers, docks, marinas and other commercial structures. Subtidal portions of the cove are generally over 8 feet deep and are heavily used as a recreational boat anchorage area. Intertidal habitat along the east and west shores of the cove is generally steep in gradient and composed of coarse substrate, including bedrock outcrops. There are approximately 4-5 acres of intertidal mud flats at the south end of the cove that support a macrobenthic community which includes: rockweed, sea lettuce, blue mussels, soft-shelled clams, sand worms, periwinkles, barnacles and other invertebrates. Resident and migratory finfish species within the project area include: winter flounder, Atlantic silversides, stickleback, mummichog, Atlantic and blueback herring, mackerel and smelt. Smith Cove is used as a resting and feeding area by wintering waterfowl such as black duck and red-breasted merganser. Other bird species in the vicinity include black-backed and herring gulls, terns and various shorebirds. A snowy egret and two semi-palmated plovers were observed feeding on the intertidal flat during collection of the benthic samples (p. EA-IV 17).

Our previous comments on the project indicated that we consider dredged material from Smith Cove to be ecologically unacceptable for open water disposal. This determination was based on the bioassay-bioaccumulation test results that showed uptake levels of aliphatic petroleum hydrocarbons in grass shrimp and sand worms and PCB's in grass shrimp were higher in organisms exposed to Smith Cove dredged material than those exposed to the reference sediment. We understand the only instance of contaminant uptake demonstrated to be statistically significant was PCB's in grass shrimp.

Despite our recommendation for confined, preferably upland, disposal due to the contaminated nature of Smith Cove dredged material, the Corps found the material to be ecologically suitable for open water disposal based on the bioassay-bioaccumulation studies. These studies were conducted in accordance with the testing protocols presented in the EPA/Corps ocean disposal implementation manual. On several occasions we have pointed out major shortcomings of the biological testing protocol which in our opinion bias study results and subsequent decisions regarding ocean disposal. Examples of result-biasing procedures include: (1) the relatively small volume of test sediments used; (2) the lack of a sediment resuspension system that would mimic natural conditions and make certain contaminants more bioavailable; (3) complete volume changes in test chambers every six hours which flush contaminants from the aquaria; (4) the use of a test species (Mercenaria) that is capable of inactivity during its exposure to contaminated sediments; (5) the use of a testing procedure that allows Palaemonetes to be exposed to only the liquid phase of the test medium; (6) depuration times that allow for metabolism of accumulated contaminants; (7) the location of the reference site near the disposal site, allowing for contamination of these sediments; (8) the failure to compare test results to control data and; (9) the lack of certain QA/QC procedures in testing laboratories.

A revised Open Water Disposal Dredged Material Testing Protocol has recently been assembled through a joint effort of the EPA, Corps, Fish and Wildlife Service (FWS) and National Marine Fisheries Service. While this new testing protocol does not contain all of the procedures, techniques, and requirements necessary to achieve full support and approval of the FWS, it is nevertheless an improvement over the previous method. The new testing protocol incorporates a tiered approach to bioassay-bioaccumulation analyses, new chemical parameters to tested for, updated detection limits, new test organisms, and quality assurance/quality control procedures. We understand the EPA began implementation of the new protocol, which applies to all proposals for dredged material disposal in open waters under Corps' regulatory jurisdiction, on August 15, 1989. In order for the proposed navigation dredging to conform with the current testing requirements for ocean disposal, Smith Cove sediment must be analyzed using the new biological testing protocol. Retesting of Smith Cove sediments using the new protocol is biologically justified because of the documented potential for bioaccumulation of sediment contaminants using the old, less refined, protocol.

In our previous comments, we recommended that the proposed anchorage area be sited to avoid direct or indirect impacts to intertidal habitat at the south end of Smith Cove. Specifically, we recommended that any proposed facility not be sited closer than -2 or -3 feet MLW or 50 feet horizontally from the intertidal habitat. Upon review of the draft DPR, we find that the project does not conform to the recommended criteria. Based on the sounding data shown on Figure EA-2, it appears that over one-half of the proposed anchorage would be dredged from intertidal habitat. We disagree with the estimate on page EA-12 that only 0.04 acres of intertidal habitat (erroneously identified here as subtidal habitat) would be affected by dredging. We understand the estimate of intertidal habitat impact was based on tidal elevation 0.0, MLW, as the threshold between intertidal and subtidal habitat. The Fish and Wildlife Service (Cowardin et al. 1979) defines subtidal habitats as those where the substrate is permanently flooded with tidal water. Intertidal habitats include those that are irregularly exposed (substrate is exposed by tides less than daily), regularly flooded (tidal water alternately exposes the land surface at least once daily), and irregularly flooded (tidal waters flood the land surface less than once daily). According to the tide tables for Gloucester Harbor, low tide levels fall below 0.0 MLW at some point during every month of the year and reach a low of about -1.8 feet. Using this as an approximate threshold between subtidal and intertidal habitat, it appears that over 1.5 acres of intertidal habitat would be eliminated by dredging.

The conversion of intertidal mudflats to subtidal habitat would be accompanied by a loss of benthic habitat and associated wildlife habitat values. Migratory birds, including shorebirds and wading birds, have been observed feeding on the intertidal flats at the study site. Wintering waterfowl are known to utilize the area. Intertidal habitats support mollusk and crustacean prey items that either do not occur or are not as abundant in subtidal habitats. For example, benthic sample No. 3, which lies between elevation -0.5 and -1.0 within the proposed dredge area, had soft-shelled clam, periwinkle, and the isopod Jaera as codominants in the benthic community with the polychaete Capitella. The other three stations, all located deeper than -8.0, were dominated solely by Capitella (p.EA-IV 9). Even if the dredged subtidal anchorage is recolonized by clams and other prey organisms, they would not be available to some avian species, e.g. shorebirds that feed along the waters edge.

In summary, we consider dredge materials from Smith Cove to be ecologically unacceptable for open water disposal. Testing indicates a potential for copper and PCB elution above EPA water quality criteria as well as PCB and petroleum hydrocarbon uptake by marine organisms. We previously recommended that dredged materials be physically contained in an upland or other diked disposal area. Since the Corps proposes to dispose of these sediments at the Foul Area Disposal Site in Massachusetts Bay, the material should be retested using the revised Open Water Disposal Dredged Material Testing Protocol to determine if the material meets current biological standards for ocean disposal. We also recommend that any dredged anchorage or navigation facility not be sited closer than -2 or -3 feet MLW or 50 feet horizontally from the intertidal habitat. These vertical and horizontal clearances should provide an adequate buffer from impacts associated with commercial uses of the anchorage.

We appreciate the opportunity to review and comment on the draft Detailed Project Report. Please contact Mike Tehan of my staff if we can be of further assistance.

Sincerely,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Area

SECTION A

RESPONSES TO DRAFT REVIEW COMMENTS

Responses to National Marine Fisheries Service (NMFS) (December 22, 1989)

1. Economic Analysis: It is valid to state that the quantity of large trawlers and the stock they harvest has declined in recent years. However, due to an extreme lack of mooring space most large boats raft together and hence, do not increase available moorings if they leave the fleet. Rafting of smaller vessels would cause additional damages to those boats.

The fishing fleet in Gloucester Harbor is adapting to changing times and are using smaller more efficient vessels targeting higher quality/higher value catch. The quantity of smaller boats (25-55 feet in length) is increasing. Approximately 35 smaller commercial fishing vessels are listed on a waiting list for mooring space. Further evidence of the need to provide additional small boat anchorage area is the presence of 40 to 50 foot gillnetters that seem to be replacing larger trawlers, and more vessels are required to rent winter slip space due to the overcrowded conditions. Our re-examination of the without project condition is current and valid.

NMFS commented on benefits attributed to reduced tidal delays and the opportunity cost of a fisherman's lost time. These benefits are valid and were estimated in accordance with appropriate Corps of Engineers guidelines.

2. Wetlands Analysis: We concur with the National Marine Fisheries Service comment regarding the selected plan's impact on intertidal habitat. In response to this, the New England Division, in coordination with Gloucester resource officials and Federal and State resource agencies, has developed a mitigation plan to compensate for unavoidable project impacts. Mitigation plans for Smith Cove were developed using Corps policy guidance for fish and Wildlife mitigation planning. In compliance with EPA/Corps guidelines, a sequential approach was used in developing mitigation alternatives. Restoration of 2 acres of degraded marsh in the Gloucester/Annisquam River system is recommended as a project feature. Marsh restoration is in concert with the "no net loss" goal of Federal and State agencies. This mitigation plan is an integral component of the recommended plan of improvement.

Sediment Disposal Suitability: The Corps does not agree with the National Marine Fisheries Service contention that material to be dredged is significantly contaminated. Sediments are contaminated with moderate levels of oil and grease, copper, and zinc and high levels of lead. Elevated levels of copper and PCB's in excess of the EPA Water Quality Standards are those of ambient conditions. in the bioaccumulation studies, concentrations in the test sediment for Hg, PCB's and Aromatic Petroleum Hydrocarbons in the hardshell clam; and PCB's and Aromatic/Aliphatic Petroleum Hydrocarbon in the sandworm were all below values in corresponding organisms exposed to reference sediment. The remaining tissue samples from those animals exposed to test sediment even though higher than reference values were not statistically significant in comparison to the tissue from organisms in the reference sediment. However, our assessment of the PCB level (mean of 0.09 ppm) in the test shrimp is statistically significant compared to the reference results but is not considered to be quantitatively significant and therefore is not felt to signify any potential for unacceptable environmental harm. Regarding the recent jointly developed Open Water Disposal Dredged Material Testing protocol, implemented on August 15, 1989, material tested prior to the implementation date is grandfathered from the new testing guidelines. But these sediment proposed for open water disposal will be reviewed for continued acceptability under MPRSA, in the construction phase.

3. Upland Disposal Option: During the study, contained upland disposal sites were examined. Sasaki Associates Inc. prepared a report titled Upland Dredge Material Disposal Site Analysis in 1983 for the Mass. Office of Coastal Zone Management. Four sites within a two mile radius around Gloucester Harbor were not viable due to economic or environmental constraints. Coordination with the City of Gloucester officials eliminated possible use of the city owned landfill.

Responses to the Environmental Protection Agency (EPA) comments (November 27, 1989)

1. Economic Justification: See Economic Analysis responses to National Marine Fisheries Service comments.

2. Intertidal Habitat Loss: See Wetlands Analysis responses to National Marine Fisheries Service comments.

3. Dredged Material Suitability: See Sediment Disposal Suitability responses to National Marine Fisheries Service comments.

4. The Corps has evaluated alternative to ocean disposal sites, determining that no sites are available in the area.

Responses to Massachusetts Coastal Zone Management comments (25 October 1989)

1. Dredged Material Disposal Suitability: See response to National Marine Fisheries Service. Retesting of material using the revised protocol is not necessary.

2. Intertidal Habitat Impact: See responses to National Marine Fisheries Service. Re-alignment of the project to minimize impacts is complete.

3. The Corps of Engineers does not consider dredging as fill in State waters. The foul area (Massachusetts Bay) disposal site is not in State waters and therefore disposal does not imply CWA Section 401.

4. Minimal secondary or cumulative impacts associated with the proposed project are expected. The city of Gloucester, for may years, has been evaluating the means and potential sites to improve public access to the waterfront with minimal ancillary facilities. The recommended dredging project may lead to some form of on shore development in Smith Cove which is not possible to identify at this time. Coordination with the Harbormaster, Assistant Harbormaster and members of the Gloucester Waterways Commission have confirmed that existing onshore support facilities are sufficient to accommodate the projected use of the proposed navigation improvement project. No additional onshore facilities are required for fruition of the project's objective.

Responses to Rocky Neck Area Association (RNAA) (September 20, 1989)

1. Project Justification : See responses to National Marine Fisheries Service

2. Regarding commercial project becoming recreational, the proposed project is solely for smaller commercial fishing vessels. At numerous meetings, including member of the RNAA, Corps representatives have explained the objective of the project with no concerns expressed by City of Gloucester officials. Rather a strong commitment to maintain the commercial identity of the project has been presented. The Local Cooperation Agreement (LCA) is a legal document that stipulates the project's purpose. The non-Federal project sponsor, the city of Gloucester in conjunction with the State Department of Environmental Management, must sign this document prior to project implementation. If it were found that the recommended plan was being used for other than its original objective, the Corps would first seek compliance and if not successful, de-authorization.

3. Defining "Commercial": The report clearly describes the project's objectives to improve the operating efficiency of the commercial fishing fleet in Gloucester. See the Executive Summary.

4. Cost Sharing: The city of Gloucester has verbally and has written their ability and intent to comply with all non-Federal project sponsor responsibilities. The LCA, specifically outlines funding and other responsibilities of both. Federal and non-Federal interests. The ability to comply must be shown and the LCA signed prior to project implementation.

5. City officials including the Police Chief/Harbormaster has offered that complaints of excessive noise and other forms of pollution would be dealt with including using the authority to remove a violator from a mooring.

6. According to our research, tidal flushing occurs every 17 hours. Tidal flushing in the cove would minimize any additional impacts from additional boating in the cove. See response 5 above. Existing onshore facilities and their discharge systems are not a Corps responsibility.

7. Boring samples were taken within the proposed project area to determine sediment stratification, and the presence/elevation of ledge rock within the area proposed for dredging.

8. Wildlife: An environmental mitigation is recommended as a component of the proposed dredging project. See responses to National Marine Fisheries Service.

9. Historical: The historical significance of Gloucester regarding boating and commercial fishing, all but Rocky Neck is not specifically noted, is presented in the report.

Responses to United States Coast Guard (USCG) (September 1989)

1. Concur. Cost estimates for aids to navigation have been deleted from cost estimates.

Response to Project Abutter Comments (September 21, 1989)

1. Project Need: See responses to National Marine Fisheries Service

2. Existing facilities management is not a Corps responsibility.

3. The estimated annual maintenance costs are a Federal responsibility. The non-Federal project sponsor, city of Gloucester/State Department of Environmental Management, is responsible for 20% of project costs.

4. Wildlife concerns have been addressed by the inclusion of a mitigation plan calling for 2 acres of marsh restoration into the recommended plan of improvement.

Responses to Project Abutter (September 21, 1989)

1. Project Justification: See response to National Marine Fisheries Service.

2. The Corps has evaluated potential increases in pollution in Smith Cove resulting from project implementation and have determined that no significant degradation would result. See responses to Rocky Neck Area Association.

3. At several meetings with city officials, parking on the causeway was stated as not posing a problem.

4. Regarding noise and other pollution, see response to Rocky Neck Area Association.

Response to U.S. Fish and Wildlife Service (USF&WS) (August 28, 1989)

1. We disagree with the contention that the previous national testing protocol developed by the Environmental Protection Agency (EPA) and the Army Corps of Engineers (ACOE) presents a biased result. The bioassay/bioaccumulation procedures used for this testing program were the same procedures used by the EPA/ACOE in the Field Verification Program (FVP). The FVP study showed that these procedures overestimated the "potential" for impact on the disposal site by dredged material and as such are conservative estimators. These procedures were developed by a national team of experts to evaluate the impact of the disposal of dredged material on the marine environment (Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters, Implementation Manual for July 1977).

The Disposal Area Monitoring System (DAMOS) program has been monitoring the Massachusetts Bay disposal site (MBDS), formally the Foul Area Disposal Site, since 1973. The DAMOS program has not found any adverse impact on the benthic population other that that due to the physical disturbance caused by disposal.

The reference site for bioassay/bioaccumulation testing has not been shown to be contaminated by dredged material in surveys by both the ACOE and EPA (see(7) of paragraph 6 of your letter). In addition, the purpose of control samples is to serve as quality control of the testing procedure and not to be used to evaluate the bioassay/bioaccumulation results of the dredged material testing (see (8) of paragraph 6 of your letter).

New England Division, ACOE began implementation of a draft version of the new protocol on September 1, 1989 as per agreement with IPA Region 1. All testing performed after this date must follow the procedures in the new protocol. However, these procedures were developed in anticipation of a new national testing protocol which has as yet been approved. As stated above, the protocol used in conducting the bioassays for Smith Cove followed the procedures recommended in the existing national manual.

2. The Corps concurs with USF&WS regarding the impact on approximately 1.5 acres of intertidal habitat. A mitigation plan calling for restoration of 2 acres of degraded marsh in the Gloucester/Annisquam River system is recommended and is an integral part of implementing the selected improvement plan. See responses to National Marine Fisheries Service and the Environmental Assessment section of this report.

APPENDIX 3

SECTION B

COPIES OF CORRESPONDENCE RECEIVED PRIOR
TO REVIEW OF DRAFT DETAILED PROJECT REPORT

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Management

May 10, 1989

DIVISION OF WATERWAYS

100 Cambridge Street
19th Floor
Boston, MA 02202
(617) 727-8893

349 Lincoln Street
Bldg. #45
Hingham, MA 02043
(617) 740-1600

Joseph L. Ignazio, Chief
Corps of Engineers, Planning Division
424 Trapelo Road
Waltham, Mass. 02254

RE: Gloucester - Federal Dredging
Project in Smith's Cove

Dear Mr. Ignazio:

At a meeting held on May 3, 1989 our engineers met with representatives of the City of Gloucester to discuss the above-captioned project.

It is our understanding that the project is anticipated within the next fiscal year. Unfortunately we will not be able to participate in the funding of this project as all our available funding is committed to projects previously petitioned for at the past two Rivers and Harbors hearings. Additionally the recent spending cap placed on our programs for fiscal years 1989 and 1990 have caused a backlog of projects which will prevent us from undertaking any new projects until fiscal year 1994 which begins July 1, 1993.

We do however stand prepared to meet our commitment by preparing and executing a Federal and State agreement for the project. Upon receipt of that agreement we will enter into an agreement with the City which will mirror the responsibilities and assurances in the Federal and State, or local agreement, as your office refers to it, and then proceed to process the Federal and State.

This overall process usually takes 90 to 120 days especially when it occurs in June or July which is the changing of our fiscal year. Therefore you should forward the agreements to this office as soon as possible so we can immediately start.

Should you have any questions please contact me at 740-1600 or Mr. Kevin Mooney at 740-1601.

Very truly yours,

Eugene F. Cavanaugh
Director

EFC: mc

cc: Honorable William B. Squillace, Mayor

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Management

May 10, 1989

DIVISION OF WATERWAYS

100 Cambridge Street
19th Floor
Boston, MA 02202
(617) 727-8893

349 Lincoln Street
Bldg. #45
Hingham, MA 02043
(617) 740-1600

Honorable William B. Squillace
Office of the Mayor
City Hall
Gloucester, Mass. 01930

RE: Gloucester - Federal
Dredging Project at
Smith's Cove

Dear Mayor Squillace:

At a recent meeting with the Corps of Engineers and City personnel we discuss the above captioned project. We were advised that the project was to take place in the next fiscal year which commences July 1, 1989.

We received a verbal request for state participation in the funding of this project to which our staff responded negatively. Unfortunately our available funding has been committed to projects petitioned for at our two previous Rivers and Harbors hearings.

The Division has had to reduce our Capital Program for 1989 from $14 Million to $2.8 Million and we anticipated our spending level to be held at approximately the same level for FY 1990. Obviously this results in a backlog of projects which includes Improvements to the State Pier, Removal of Sunken Vessels in the Harbor, Reconstruction of the Breakwater at Lanes Cove and Dredging and Erosion Control at Hodgkins Cove.

We are proceeding the design contract to remove the Sunken Vessels and anticipate enough funding in FY 90 to complete this project. This would require at least $3.5 Million to be authorized for our program. We are also proceeding with the design of the improvements to the state pier and we have sufficient funds to complete approximately half of the work in FY 90. The remaining funding of $2.41 Million will not be available until fiscal years 1991 and 1992. This is also the case for the Lanes Cove and Hodgkins Cove projects. To accomplish these projects we would have to be allowed to spend at least $12.5 Million and $10.0 Million in each of the respective years.

These aforementioned projects are a significant amount of our capital funding and it would be very difficult for us to consider funding a new project for Gloucester at this time. However under a seperate cover we have sent you a copy of a pamphlet which provides information for filing petitions at our Rivers and Harbors Hearings. This information could be used to prepare a petition for our next hearing which will be scheduled if additional funding is provided.

We have notified the Corps of Engineers that although we can not participate in the funding of the project we are prepared to assist the municipality by entering into an agreement with the municipality which will allow us to execute the required Federal and Local Agreement previously forwarded to your office by the Corps. Our agreement would simply mirror the responsibilities and assurances identified in their agreement to the municipality. Upon execution of the State and Town agreement we would process the State and Federal (Local) agreement.

The agreement process usually takes approximately 90 to 120 days so it is important that you forward any information to this office as soon as possible.

Very truly yours,

Eugene F. Cavanaugh
Director

EFC: mc

cc: Mark Habel Corps.

CITY OF GLOUCESTER

GLOUCESTER • MASSACHUSETTS • 01930

HARBOR POLICE - HARBORMASTER
197 MAIN STREET

April 25, 1989

Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Attention: Colonel Thomas A. Rhen

Dear Colonel Rhen:

This letter is to affirm the position of the harbormaster with regard to the mooring of vessels in federal anchorages. Gloucester Harbor, as well as Lobster Cove in Annisquam are federal anchorages, having been dredged with federal funds and the future dredging of the flats at the back of Smith Cove will provide a federal anchorage for commercial vessels only.

It is the policy of this office, as required by federal regulations, to issue mooring spaces on a first come, first serve basis to any citizen of the United States who requests to moor here. We have permit holders with residences in New York, Connecticut, New Hampshire, Florida, Kentucky and other states as well as permit holders from cities and towns in Massachusetts.

We maintain a waiting list with names of persons who reside out of state as well as in Massachusetts.

Sincerely yours,

Earland Worthley

Earland R. Worthley
Harbormaster

mt

cc: Don Birmingham, Coastal Development Branch

CITY OF GLOUCESTER

GLOUCESTER • MASSACHUSETTS • 01930

April 15, 1988

Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Attention: Colonel Thomas A. Rhen

Dear Colonel Rhen:

We have read the review draft of the "Local Cooperation Agreement between the Department of the Army and the City of Gloucester, Massachusetts for construction of the Smith Cove, Gloucester Harbor, Navigation Improvement Project" and look forward to your continued efforts to expedite the steps necessary to begin the actual dredging.

The expansion of the state fish pier in the near future and the loss of mooring space caused by it will place an even greater burden upon us to provide moorings for the commercial vessels which will be displaced. It is our hope that the dredging will be accomplished prior to the commencement of the state pier project.

The 10 percent funding to be paid up front will be in place through funds generated by boat excise taxes (Chapter 60B, Section 2, paragraph (i)) established under the provisions of clause 72 of section five of chapter 40 and from boat mooring fees.

Thank you for your support of this project which is so important to the small commercial fishing vessels of our port.

Sincerely yours,

William B. Squillace
Mayor

mt

The Commonwealth of Massachusetts
Office of the Secretary of State
Michael Joseph Connolly, Secretary

Massachusetts Historical Commission
Valerie A. Talmage
Executive Director
State Historic Preservation Officer

September 25, 1986

Mr. Joseph Ignazio
Chief, Planning Division
Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

RE: Proposed Navigation Improvements, Smith Cove, Gloucester

Dear: Mr. Ignazio:

My staff have reviewed materials which you submitted describing the proposed project referenced above. After review of the material, it has been determined that your proposal will not affect significant cultural, historical or archaeological resources.

This initial consultation to identify resources in the project area has been undertaken in accordance with 36 CFR 800, the Advisory Council Regulations for the Protection of Cultural Resources. Since no significant resources were identified in the vicinity of the proposal, no further compliance with Council Procedures is required.

If you should have any questions, please contact Jordan Kerber of this office. Thank you for your cooperation.

Sincerely,

Valerie Talmage

Valerie A. Talmage
Executive Director
State Historic Preservation Officer
Massachusetts Historical Commission

VAT/ls

COASTAL ZONE
MANAGEMENT

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

10 July, 1986

Judith Johnson
Planning Division, Impact Analysis Branch
NED, U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

RE: Smith Cove, Gloucester, Section 107 Small Navigation Study

Dear Ms. Johnson:

This letter is in response to your request for comments regarding the above referenced project. While we welcome the opportunity to comment in the advanced stages of project planning and commend your office for the foresight to request such timely input, the following observations are preliminary. A formal federal consistency review will be conducted upon receipt of your consistency determination.

1. The bulk sediment analysis revealed highly elevated concentrations of lead, zinc and oil and grease, as well as significantly elevated concentrations of mercury, copper and vanadium. It appears that, according to 314 CMR 9.00, this material would be classified as Category III, Type B or C. This, as you know, significantly reduces disposal options.

2. The bioaccumulation testing indicated, contrary to the findings of the consultant, that the potential exists for bioaccumulation of PCB, as shown by the statistically significant accumulation of PCB in Palaemonetes. Given that the bioassay seemed to suggest that the material was suitable for ocean disposal and the PCB concentrations appear to be relatively low, our office will need further time to review the information and evaluate the results before any final recommendations can be made.

3. The results of the elutriate test indicate that copper concentrations exceed the EPA standard for at least half the replicates.

Judith Johnson, COE
10 June, 1986
Page 2

4. The benthic invertebrate study, while sufficient to provide a qualitative evaluation of the site, may be somewhat limited in its ability to afford a basis for quantitative analysis. Although a 0.5 mm seive was used (a welcome step beyond the usual 1 mm standard), given that two of the predominant organisms were <u>Capitella</u> spp. and Oligochaetes, both of which are quite small (especially the early life stages) and not always retained to an acceptable level on seives of this size, a finer mesh seive might have been considered.

5. Although the dredging does not appear to be within the Designated Port Area of Gloucester Inner Harbor, dredges and barges will presumably pass through this area. Consideration should be given to assuring that this activity does not interfere with normal commercial traffic within the Designated Port.

6. If you have not already done so, we would recommend that both the regional NMFS office and the Massachusetts DMF be contacted for comments at this time.

7. Reviewing the bathymetry, it would seem that most of the cove is already deep enough to allow adequate moorage for most recreational and small commercial vessels. Given the somewhat marginal character of the sediments, perhaps the scope of the project could be reduced, dredging only certain upper portions of the proposed turning basin.

Again, thank you for the opportunity to comment at this time. Should you have any questions, please feel free to contact me at 727-9530.

Sincerely,

Bradley W. Barr

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. BOX 1518
CONCORD, NEW HAMPSHIRE 03301

Mr. Joseph Ignazio, Chief
Planning Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

JUL 02 1986

Dear Mr. Ignazio:

This responds to your June 19, 1986 request for information on the presence of Federally listed and proposed endangered or threatened species within the impact area of a navigation improvement project at Smith Cove in Gloucester, Massachusetts.

Our review shows that except for occasional transient individuals, no Federally listed or proposed threatened and endangered species under our jurisdiction are known to exist in the project impact area. However, you may wish to contact the Massachusetts Natural Heritage Program for information on state listed species. No Biological Assessment or further consultation is required with us under Section 7 of the Endangered Species Act. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to endangered species under our jurisdiction. It does not address other legislation or our concerns under the Fish and Wildlife Coordination Act.

A list of Federally designated endangered and threatened species in Massachusetts is enclosed for your information. Thank you for your cooperation and please contact us if we can be of further assistance.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Area

Enclosure

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Connecticut River & Atlantic Coastal Waters
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic straggler in Southern New England
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic straggler in Southern New England
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer resident
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident
Turtle, Atlantic ridley*	Lepidochelys kempii	E	Oceanic summer resident
Turtle, Plymouth red-bellied	Chrysemys rubriventris bangsi	E	Plymouth & Dukes Counties
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	E	Entire state
Falcon, American peregrine	Falco peregrinus anatum	E	Entire state-reestablishment to former breeding range in progress
Falcon, Arctic peregrine	Falco peregrinus tundrius	E	Entire state migratory-no nesting
Plover, Piping	Charadrius melodus	T	Entire State - nesting habitat
MAMMALS:			
Cougar, eastern	Felis concolor couguar	E	Entire state - may be extinct
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp. (all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS:			
NONE			
PLANTS:			
Small Whorled Pogonia	Isotria meleoloides	E	Hampshire, Essex Counties

*Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service

Rev. 2/11/86

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Management Division
Habitat Conservation Branch
2 State Fish Pier
Gloucester, MA 01930-3097

June 23, 1986 F/NER74:DB

Mr. Joseph L. Ignazio
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Dear Mr. Ignazio;

This is in response to your letter to Douglas Beach dated June 19, 1986, requesting a list of endangered or threatened species present in the area of a dredging project at Smith Cove in Gloucester, Massachusetts pursuant to Section 7(c) of the Endangered Species Act of 1973 (ESA).

We have identified the presence of no endangered or threatened species in the project area that come under the jurisdiction of the National Marine Fisheries Service. However, the Foul Area Disposal Site is inhabited by endangered humpback (Megaptera novaeangliae) and fin (Balaenoptera physalus) whales from May until October, and the endangered right whale (Balaena glacialis) inhabits the area from March through May. The type and quantity of material that will be disposed, the contaminant levels in the material, and more detail on the method and timing of the disposal must be clearly described in order to assess the potential effects of the project on the endangered species mentioned above.

For your information, we are attempting to reduce the need for duplicate responses on projects with marine resource and endangered species concerns. Henceforth, our field station representatives will address endangered species concerns in their initial response to any project. This should streamline the review process by including the preliminary Section 7 screening for the presence of endangered species in the initial review by our field staff. Therefore, for those projects where the Corps needs a written response under the ESA, please ask our field representative to incorporate endangered species concerns in their review. Should endangered species become a concern for any project, I will be notified by the field representative, and will become involved in the project review process if necessary. If you have any questions on this, please contact me at FTS 837-9254.

Sincerely,

Douglas W. Beach

Douglas W. Beach
Wildlife Biologist

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. BOX 1518
CONCORD, NEW HAMPSHIRE 03301

MAR 2 2 1985

Mr. Joseph Ignazio, Chief
Planning Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Mr. Ignazio:

This Planning Aid Letter is intended to assist your planning efforts on the Smith Cove, Gloucester Harbor Section 107 Navigation Study. It is submitted in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.).

It is our present understanding that the most likely federal navigation project for Smith Cove is an anchorage area located in the southern end on tidelands held by the City of Gloucester. The exact boundaries of the proposed anchorage are as yet, unidentified.

Smith Cove is an embayment within the inner harbor at Gloucester, Massachusetts. It was formed by constructing a causeway on an intertidal bar between East Gloucester and Rocky Neck, an island in Gloucester Harbor. Smith Cove encompasses an area of approximately 22 acres of which about 4-5 acres at the south end are intertidal mud flat. The remaining intertidal areas on the east and west shores have a steeper gradient and are composed of coarse substrate including bedrock outcrops. The subtidal portions are generally 8-17 feet deep at MLW and used extensively as a boat anchorage area. The shoreline is extensively developed with houses, piers, docks, marinas and other commercial structures. Land uses in Smith Cove include private and commercial anchorage and docking facilities and other water dependent and nondependent commercial enterprises.

Living resources in Smith Cove include finfish such as winter flounder, Atlantic silversides, sticklebacks, mummichogs and transient visitors such as Atlantic and blueback herring, mackerel and smelt among others. Larval and juvenile forms of the above referenced species and other euryhaline and marine species can be found in Smith Cove as well as other parts of Gloucester Harbor. The dominant intertidal macrobenthic community includes rockweed, blue mussels, soft-shell clams, sand worms, mud snails, periwinkles and barnacles. Waterfowl such as black ducks and mergansers use Smith Cove as a resting-feeding area during the winter season. Other avifauna include great black-backed and herring gulls, terns and various shorebirds. At the time of our field investigation in mid-March, we found an abundant population of sand or clam worms (Nereis virens), modest numbers of blue mussels and low numbers of soft-shell clams. The presence of large numbers of empty shells suggest that the clam population has recently been depressed by pollution, predation, disease or a combination of factors. In accordance with the Fish and Wildlife Service Mitigation Policy, we consider the intertidal and shallow subtidal habitats to be resource category 2. We were unable to locate any existing site-specific data on the subtidal benthic community in Smith Cove.

The sediment data for Smith Cove indicates that the material is primarily silt or clay and is significantly contaminated with oil and grease, copper, zinc and lead. Our review of the bioassay-bioaccumulation data shows a statistically significant difference between sand worms and grass shrimp exposed to control sediment and Smith Cove "dredge" sediment regarding uptake of aliphatic petroleum hydrocarbons and uptake of PCBs by grass shrimp.

Based on our review of the bioassay-bioaccumulation results, the dredge material from Smith Cove is not ecologically acceptable for open water disposal. During our review of the bioassay-bioaccumulation test, we noted several procedural matters of concern to us. The most profound of which relates to the reference sediment. This material appears to be as, or perhaps more, contaminated than the test or dredge material sediment from Smith Cove. It seems unreasonable to use contaminated material as a control sediment unless the objective is to hedge against statistical differences with the dredge material. The joint EPA-Corps dredge material testing manual clearly and specifically requires an uncontaminated sedimentologically similar sediment (pg. F2, G4) to compare against the dredge material. In addition, the reference manual requires several reference site samples to measure variability of the sediments and effects from previous disposal operations (pg. F2, F3, G3 and G4). We believe the only infallible method to insure that the sedimentologically similar control sediment is in fact, uncontaminated, is to test for the priority pollutants and other known toxic nonconventional pollutants. Contaminants in the control test sediments should be at or below natural background levels for the metals and below detection limits (i.e., nonexistent) for the anthropogenically produced organic compounds.

The test organisms (grass shrimp and hard clams) used in the bioassay-bioaccumulation test are not, in our opinion, the most appropriate species to measure or identify acute or chronic toxicity or uptake of contaminants. Consideration should be given to using a mysid shrimp to replace the grass shrimp and the sheepshead minnow or mummichog would be a preferable test species to the hard clam because of greater sensitivity. The length of the solid phase bioassay-bioaccumulation test needs to be extended to 30 days or longer to allow for the physiological processes of contaminant uptake-depuration to stabilize. The 10-day test period is not sufficiently long to allow for these processes to stabilize. The absence of lab notes recording the physiological and other processes of the test organisms during the test seriously detracts from the value and usefulness of the solid phase bioassay-bioaccumulation test. Information relating to test organism movements, locations within the sediment or aquaria, burrowing or tube building activities, siphoning or pumping activities, feeding or excreting behavior, activity level and general health or well-being are important data to utilize in interpretating test results. It is important to know if the hard clams shut down (i.e., quit pumping) during part or all of the test period and if the grass shrimp stayed up on the sides of the aquaria away from the contaminated sediments. We could not determine if sediment resuspension was employed during the test in an attempt to simulate events occurring at the disposal site. The laboratory procedure of clearing excess suspended sediment from the aquaria prior to adding the test organisms could bias the test because available contaminants would be flushed from the system along with the fine grained sediments. Organisms used as pretest tissue samples were taken randomly from reference and control sediment aquaria during the 48 hour acclimation period. This may have an influence on contaminant levels in the pretest organisms exposed to the reference sediment. Likewise, the test could be biased by acclimating the organisms to the contaminated reference sediment and then exposing them for 10 days to the dredge (Smith Cove) sediment.

These points regarding resuspension, activity of test organisms and the time factor in uptake and depuration results are the subjects of on-going research by EPA, NMFS and others. Results to date indicate that all of these factors are critical in bioassay/bioaccumulation studies.

In summary, we do not believe the dredge materials from Smith Cove are acceptable for open water disposal and recommend that they be physically contained in an upland or other diked disposal area. With regards to dredging an anchorage in Smith Cove, we recommend that any proposed facility not be sited closer than -2 or -3 MLW or 50 feet horizontally from the intertidal habitat. These vertical and horizontal clearances should provide a sufficient safety zone to safeguard these resources from direct physical abuses from the anchorage and its associated uses.

If you should have any questions concerning this letter or desire further coordination relative to the development of acceptable bioassay-bioaccumulation test criteria and procedures, please feel free to contact Mr. Vern Lang at this office (FTS 834-4797).

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Field Office

City of Gloucester
Harbor Police - Harbormaster

MASSACHUSETTS • 01930

March 8, 1984

U. S. Army
New England Division
Corps of Engineers
Coastal Development Branch
424 Trapelo Road
Waltham, MA 02154

Attention: Michael Misslin

Dear Sir:

The Harbormaster hereby advises the Corps of Engineers that it can neither support or condone the dredging of tidelands between the Commissioners Line and the mean high water or uplands at the head of Smith Cove with the exception of those areas owned by the City of Gloucester.

The reasons for the above position are set forth below.

1. Smith Cove is one of the few areas in the Commonwealth of Massachusetts where tidal lands below the high water mark were divided up amongst the owners of uplands, and this division was given approval by the Land Court.

2. The City of Gloucester is currently one of the owners and as a public entity does endorse the dredging of its flats so as to make the public uplands available to the boating public. The city is therefore willing to give a quit claim covenant to the federal government for all city owned tidelands below the highwater mark at the head of Smith Cove

The city cannot however, endorse dredging those other areas that are claimed by private parties because municipally endorsed and supported excavation of subject flats inside the Harbor Commissioners Line could expose the City of Gloucester and the Commonwealth to law suits concerning illegal expropriation of real property.

We understand that the Federal Government may not recognize the claim referred to above. It is however, recognized by the state, and we wish to make it clear that the unilateral pursuit of this project by the Army does not have either the support or consent of the City of Gloucester.

The enclosed chartlet reflects this office's recommendation for a suitable channel to reach the city owned parcel at the head of Smith Cove.

Sincerely yours,

Earland R. Worthley

Earland R. Worthley
Harbormaster

cc: D.E.Q.E., Boston
City Planner, City of Gloucester

CITY OF GLOUCESTER

GLOUCESTER · MASSACHUSETTS · 01930

November 3, 1983

Colonel Carl Sciple
Division Engineering
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Dear Colonel Sciple:

The City of Gloucester is most interested in continuing the current feasibility study undertaken by Army Corps of Engineer's personnel in the Smith Cove area of Gloucester Harbor. The City is most anxious that you proceed into a detailed project study.

The City of Gloucester has the capability of meeting Federal assurances re: small projects constructed under Section 107 of the Rivers and Harbors Act of 1960.

Your assistance and cooperation is deeply appreciated.

Sincerely

Leo I. Alper
Mayor

LIA/ch

CITY OF GLOUCESTER

GLOUCESTER · MASSACHUSETTS · 01930

June 24, 1982

Department of the Army
New England Division
Corps of Engineers
℅ Colonel C.E. Edgar, III
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Colonel Edgar:

In response to your letter of March 8, 1982, the City of Gloucester requests the Corps of Engineers to continue with the detailed project investigation of Gloucester Harbor under the authority of Section 107 of the 1960 River and Harbor Act, as amended.

The City understands that a detailed project report will determine the economic and engineering feasibility, environmental impacts and the social and cultural impacts of the proposed navigation improvements for commercial fishing interests. If approved, initiation of the Detailed Project Report is scheduled for the Fall of 1984.

Specific items of local cooperation can be agreed to prior to the preparation of any plans and prior to actual construction.

Thank you for this opportunity. The staff of the Planning and Community Development offices look forward to working cooperatively with the Corps of Engineers.

Sincerely,

Robert P. Schernig

Robert P. Schernig, A.I.C.P.
Director of Planning & Community Development

RPS/cg

CITY OF GLOUCESTER

GLOUCESTER · MASSACHUSETTS · 01930

OFFICE OF CITY CLERK

March 11, 1981

Army Corps of Engineers
424 Trapelo Road
Waltham, MA. 02154

Gentlemen:

Please be advised that the Gloucester City Council at its regular meeting held on March 3, 1981, voted unanimously to adopt the following motion:

> That the Mayor and City Council of the City of Gloucester notify the Army Corps of Engineers that the Council urgently request that deep-water dredging needs in Gloucester Harbor be studied by your department to determine which portions of Gloucester Harbor be dredged.

Your cooperation will be sincerely appreciated.

Yours very truly,

Fred J. Kyrouz

FRED J. KYROUZ
CITY CLERK

FJK/h